INDEX OF SPECTRA

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WITH AN INTRODUCTION

ON THE

METHODS OF MEASURING AND MAPPING SPECTRA

REVISED EDITION, GREATLY ENLARGED

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PREFACE.

In the first edition of this book, published in 1872, an attempt was made to bring together the existing measurements of spectra, and to present them upon a uniform scale of wave-lengths. Since that date, spectroscopic research has been very active, and the mass of material dealt with in the present edition is very large, not only because so many more competent observers have entered the field and because they are provided with greatly improved instruments, but also because new methods have enabled them to extend their observations into the ultra-violet and the infra-red regions of the spectrum. The mass of materials has been so great that the author would hardly have ventured upon the task if he had not received the valuable assistance of a committee[1] of the British Association appointed at the meeting at York 'to prepare a new series of wave-length tables of the spectra of the elements and compounds.' These tables were printed in the Reports of the Association for the years 1884, 1885, and 1886, and the bulk of the present work consists of reprints of these tables, but with important additions. It has been possible to incorporate in the reprints the results of certain valuable researches which were published too late to be employed in the compilation of the 'Reports;' amongst them may be mentioned Thalén's memoir 'Sur le Spectre du Fer'[2] and Fievez's 'Sur le Spectre du Carbone.'[3]

Another difference between the present tables and those of the Reports consists in the addition of a column headed 'Oscillation-frequency,' in which the lines of the spectra are recorded by the *number of wave-lengths in one centimètre in vacuo*. In the present stage of spectrum analysis, when vigorous efforts are being made, and with much success, to trace the connection between the molecular constitution of a gas and the vibrations to

[1] Consisting of Sir H. E. Roscoe, Mr. J. N. Lockyer, Professors Dewar, Wolcott Gibbs, Liveing, Schuster, and W. N. Hartley, Captain Abney, and Dr. Marshall Watts.

[2] Royal Society of Upsala, Sept. 1884.

[3] 'Mém. de l'Acad. roy. de Belgique,' xlvii. 1885.

which its radiations are due,[1] it is hoped that this method of recording spectra may facilitate research ; it is, moreover, more suitable for use with refraction-spectra and in furnishing data for interpolation—as is more fully explained in the 'Introduction.' The wave-lengths obtained by different observers are given in parallel columns and are expressed in ten-millionths of a millimètre (or tenth-mètres [2]). They are based upon the measurements of

FRAUNHOFER LINES

Designation and Origin	Wave-length in Air	Refractive Index of Air
A	7604·0	1·00029286
B	6867·0	1·00029350
C (H)	6562·1	1·00029383
D (Na)	5892·12 { 5895·13 / 5889·12 }	1·00029470
E (Ca & Fe)	5269·13	1·00029584
b_1 (Mg)	5183·10	
b_2 (Mg)	5172·16	
b_3 (Ni & Fe)	5168·48	
b_4 (Mg & Fe)	5166·88	
F (H)	4860·72	1·00029685
G (Fe)	4307·25	1·00029873
H (Ca)	3968·1	1·00030028
K (Ca)	3933·0	
L (Fe)	3819·8	1·000300955
M (Fe)	3727·0	1·000301475
N (Fe)	3580·5	1·00030212
O (Fe, double)	3439·8	1·00030336
P (Fe & Ti)	3359·2	1·00030397
Q (Fe)	3284·9	1·00030459
R (Fe & Ca)	3179·0	1·00030555
r (Fe, double)	3144·3	1·0003073 ?
S_1 (Ni, double)	3100 6 } 3100·0	
S_2 (Fe, triple)	3099·5 }	
s (Fe)	3046·4	
T (Fe, double)	3019·7	
t (Fe)	2994·3	
U (Fe)	2947·8	

[1] Mitscherlich, 'Phil. Mag.' xxviii. 169.
Mascart, 'Compt. Rend.' clxix. 1869.
Stoney and Reynolds, 'Phil. Mag.' (4) xli. 291 ; xlii. 41 (1871).
Lecoq de Boisbaudran, 'Compt. Rend,' 1869, pp. 106, 659; 'Ann. Sc. de la Charente-Inférieure,' 1870.
Soret, 'Phil. Mag.' xlii. 464 (1871).
Ciamician, 'Ber. kais. Ak. Wiss. zu Wien,' xvii. 138 (1880).
Liveing and Dewar, 'Phil. Trans.' 1884.
Cornu, 'Compt. Rend.' xcvii. (1884); c. 1181 (1885).
Balmer, 'Journ. de Physique,' 1886 ; 'Wied. Ann.' xxv. 80.
Deslandres, 'Compt. Rend.' ciii. 375 (1886); cvi. 842 (1888).
Grünwald, 'Mémoire de l'Acad. de Vienne,' July, 1887 ; 'Astr. Nachr.' 2797.
Nordenskiold, 'Compt. Rend.' cv. 989, 1887.
Schuster, 'B. A. Report' ; 'Nature,' xx. 532.
Hagenbach, 'Verh. d. Naturf. Ges. zu Basel.'
Liveing and Dewar, 'Phil. Trans.' clxxix. 27 (1888).

[2] Adopting the symbol μ to denote the $\frac{1}{1000}$ of a millimétre (a *micron*), the wave-length of D, may conveniently be written μ 0·588912.

the Fraunhofer lines by Ångström for the visible rays, and the extension of the same series of measurements into the ultra-violet portion of the spectrum by Cornu and other observers. The small corrections indicated at p. 29 of Ångström's memoir 'Le Spectre normal du Soleil' have been applied to his numbers, but they are uncorrected for the dispersion of air. Hence the *wave-lengths* given in the tables refer to air of 760^{mm} pressure at Upsala and at 16° C. The numbers taken from Thalén's 'Détermination des Longueurs d'Onde des Raies métalliques' have had applied to them the small corrections necessary to bring them into harmony with the numbers finally adopted by Ångström as 'Valeurs définitives' ('Recherches sur le Spectre Solaire,' pp. 25 and 31–32), as stated in the foregoing table.

In converting wave-lengths into oscillation-frequencies, they have been reduced to vacuo by multiplying by Ketteler's values of the refractive indices of air.[1] For the ultra-violet rays the refractive indices were deduced by a graphical extrapolation. A curve plotted with values of $(\frac{1}{\lambda})^2$ as abscissæ and of $\mu-1$ as ordinates was nearly a straight line, and gave the values stated above. The wave-lengths have then to be multiplied by these numbers, or, what is more convenient in practice, increased by a certain amount as stated in the following table, when it is not desired to go beyond the first decimal place.

TABLE OF CORRECTIONS TO BE APPLIED TO WAVE-LENGTHS IN AIR TO REDUCE TO VACUO.

Between	7692	and	7342	add	2·2
„	7342	„	6992	„	2·1
„	6992	„	6642	„	2·0
„	6642	„	6292	„	1·9
„	6292	„	5942	„	1·8
„	5942	„	5588	„	1·7
„	5588	„	5235	„	1·6
„	5235	„	4890	„	1·5
„	4890	„	4538	„	1·4
„	4538	„	4180	„	1 3
„	4180	„	3824	„	1·2
„	3824	„	3459	„	1·1
„	3459	„	3096	„	1·0
„	3096	„	2730	„	0·9
„	2730	„	2363	„	0·8
„	2363	„	1994	„	0·7
„	1994	„	1625	„	0·6

The following symbols are employed in the tables to indicate the character of the lines :—

s denotes that the line is sharply defined.
n denotes that the line is ill-defined or nebulous.
b denotes a band, the position of the brightest part being given.
b^r denotes a band sharply defined on the least refracted side, and fading away towards the blue.
b^v denotes a band sharply defined on its more refracted side, and fading away towards the red.

[1] 'Phil. Mag.' ii. 336 (1866).

The width of a broad band is sometimes indicated by a *suffix*, giving the width in *ninth*-metres; thus, 4997 b^{r}_{5} means that the bright edge of the band is about 4997, and that it fades away about 4947; whereas 6532 b_4 means that the band extends from 6552 to 6512, its brightest point being at 6532.

c denotes that the line is continuous.
d denotes that the line is discontinuous, or a 'short' line.
r denotes that the line is frequently 'reversed.'
A number within parentheses, thus: (3091·9), means that while a line in this position has been observed, no new measurement of wave-length was made—the wave-length being quoted from another observer.

The intensities of the lines are expressed upon an ascending scale from 1 to 10; 1 being the feeblest and 10 the brightest.

Most of the measurements here brought together are given by the observers themselves in wave-lengths based upon Ångström's numbers, which seem to have been accepted with one accord as the standard of reference.

The more important exceptions are the observations of Huggins and Kirchhoff. The method of reducing Huggins's numbers is explained in the preface to the *first* edition of this work. The numbers now given from Kirchhoff have been reduced by graphical interpolation by means of the interpolation instrument specially constructed for the committee by Messrs. Cooke & Sons of York, and are based upon a careful comparison of Kirchhoff's maps with the 'Spectre normal' of Ångström. The identification of particular groups of faint lines is not always the same as in the B. A. catalogue of oscillation-frequencies (Report, 1878).

The lines chosen as starting-points for this interpolation are chiefly calcium and iron lines, and they are distinguished in the lists headed 'Kirchhoff' by brackets, *e.g.* (6161·4).

It should be noted that the lines given by Huggins are frequently more numerous in the region examined by him than those of Thalén—as in the case of arsenic, bromine, chromium, cobalt, gold, osmium, and strontium. The reason of this is probably that suggested by Thalén,[1] that in many cases he employed solutions of salts of the metals, whereas Huggins employed the metals themselves.

It appears to the author that the general agreement to adopt Ångström's numbers is a sufficient reason for not attempting (at least at the present stage) to look for more accurate determinations of the fundamental wave-lengths. It seems to be even more important to have a generally accepted standard than to have great accuracy in the absolute values.

At the same time there seems no reason to doubt the great accuracy of the recent results of Peirce, Rowland, and Bell, and the following table, based upon data kindly furnished by Messrs. Rowland and Bell, gives the correc-

[1] Page 10 of Introduction to 'Longueurs d'Onde.'

tions to be applied to the numbers of these tables to bring them into as close agreement as possible with the photographic map of Prof. Rowland.

TABLE OF CORRECTIONS TO BE APPLIED TO REDUCE ÅNGSTRÖM AND CORNU'S NUMBERS TO THE STANDARD OF ROWLAND'S MAP.

Wave-length	Correction	Wave-length	Correction
At or about 3350	+ 0·2	At 5400	+ 1·2
„ 3370	+ 0·3	„ 5410	+ 1·0
„ 3400	+ 0·4	„ 5420	+ 0·7
From 3430 to 4000	+ 0·5	„ 5440	+ 1·0
At 4020	+ 0·6	„ 5500	+ 1·1
From 4040 to 4580	+ 0·7	From 5520 to 5600	+ 1·2
At 4600	+ 0·8	At 5700	+ 1·3
From 4630 to 4700	+ 1·0	„ 5740	+ 1·2
At 4720	+ 0·9	From 5780 to 6030	+ 1·0
From 4740 to 4860	+ 0·8	„ 6030 „ 6100	+ 1·1
At 4880	+ 0·9	„ 6100 „ 6220	+ 1·0
„ 4920	+ 1·0	„ 6220 „ 6380	+ 1·1
„ 4960	+ 0·9	„ 6400 „ 6450	+ 1·0
„ 4990	+ 0·8	At 6460	+ 1·1
„ 5010	+ 0·7	From 6500 to 6600	+ 1·2
From 5020 to 5100	+ 0·6	At 6250	+ 1·1
„ 5120 „ 5170	+ 0·7	„ 6700	+ 1·0
„ 5170 „ 5200	+ 0·6	„ 6730	+ 0·9
„ 5210 „ 5260	+ 0·8	„ 6750	+ 0·8
„ 5280 „ 5310	+ 1·0	From 6770 to 6900	+ 0·7
At 5320	+ 0·8	At 6930	+ 0·8
„ 5330	+ 0·9	„ 6950	+ 0·9
„ 5340	+ 1·0	„ 6970	+ 1·0
„ 5360	+ 1·1	„ 7000	+ 1·5

The number finally adopted by Bell [1] for the absolute wave-length of D_1 (the less refrangible sodium line) is 5896·18 in air at 20° C. and 760^{mm}, or 5897·9 in vacuo.

Prof. Rowland [2] gives the following wave-lengths of the chief Fraunhofer lines :—

A (edge)	7593·97
B	6867·83
C	6562·96
D_2	5896·08
D_1	5890·12
E	5270·04
b_1	5183·73
F	4861·43
G	4307·96

It is the author's intention shortly to publish an atlas of maps of the spectra on the uniform scale of oscillation-frequencies, as a companion to the present work ; and to add to it tables supplementary to the present ones—giving later measurements as far as possible.

[1] 'On the Absolute Wave-length of Light,' 'Am. Jour.' xxxviii. p. 91 (May, 1888); 'Phil. Mag.' xxiii. 265.

[2] 'On the Relative Wave-lengths of the Lines of the Solar Spectra,' 'Am. Jour.' xxxiii. p. 183 (March, 1887); 'Phil. Mag.' xxiii. 257.

INTRODUCTION.

The best method of measuring and mapping a spectrum must, of course, depend on the object with which the spectrum is observed. If the spectroscope is employed only as an auxiliary to the ordinary methods of chemical analysis, and the object is simply to determine the presence or absence of a metal of the alkalies or alkaline earths—say lithium or calcium—very rough measurement only is needed; indeed, in most cases, the colour of the line or the general appearance of the spectrum is sufficient. But if, on the other hand, the object is, for example, the determination of the presence or absence of oxygen in the sun's atmosphere, or the description of some new spectrum observed for the first time, the case is altogether different; the greatest dispersive power that the circumstances of the case will allow must be employed, and the position of each line must be measured with the utmost accuracy attainable by the best use of the best apparatus at command.

The spectrum may, of course, be produced either by diffraction from a diffraction-grating or by refraction through a prism. The splendid diffraction-gratings furnished by Rutherford give results unapproached by any other means when the source of light is sufficiently powerful; but the intensity of a diffraction spectrum is always so much less than that of a dispersion spectrum that for most purposes of spectroscopy the prism must be employed.

For the ordinary purposes of chemical analysis, nothing can be better than a strongly-built spectroscope, provided with one prism of 60° of dense glass, and a photograph-millimetre scale, seen by reflection at the first surface of the prism.

It is not possible to construct instruments with exactly similar scales, and each instrument should therefore have its readings reduced to wave-lengths by the method of graphical interpolation, to be presently described; but it is convenient to have these reflected scales as nearly as possible similar to the one given in Bunsen's first paper.[1] On this scale the Fraunhofer lines have the following positions:—

A 17·5 B 28·9 C 35·0 D 50 E 70·9 *b* 75 F 90
G 127·3 H_1 161·2 H_2 165·7

[1] *Phil. Mag.* (Fourth Series) vol. xxvi. p 247.

and the Lithium, Strontium, and Thallium lines are as follows:—

Li 31·5 Sr δ 105·5 and Tl 67·8.

The brass mounting in which the scale is placed is always so made as to admit of movement horizontally, so that any division of the scale may be adjusted to any given line. The adjustment for the Bunsen scale is made by bringing the sodium line to 50 of the scale, the image of that edge of the slit which does not move when the breadth of the slit is altered being made to coincide exactly with the division 50. If this be on the left hand of the observer, then always the position of the left-hand edge of each line and band is to be observed, and in the case of a faint line the slit may be opened to admit more light, and yet an accurate reading may be obtained. This refers, of course, only to lines which are sharply defined, and not to bands of considerable breadth. The most convenient plan in making a map of an ordinary spectrum is first to put down, as exactly as possible, the positions of the well-defined lines on an ordinary lithographed millimetre scale, opening and closing the slit as convenient, and then to go over the work again, keeping the slit at one uniform width and noting the relative intensity of the lines and the width and character of the bands, whether sharply defined at the edges, or sharp at the one edge and fading away at the other, or bright in the middle and fading away at each edge. There is no better plan of noting the peculiarities of a spectrum than that employed by Bunsen, in which each bright line is represented by a black mark on the paper, whose height represents the intensity of the line.

A convenient modification of the scale used with the spectroscope for ordinary purposes has been proposed by Professor Emerson Reynolds.[1] The observing telescope carries cross wires, and as it moves from one line to another it causes an index-finger to travel round over a divided arc on a plate of opal glass, which is feebly illuminated by a small flame. The positions of the more important lines of the elements, whose spectra are easily obtained with the Bunsen flame, are marked on the opal plate; the identification of any particular element is thus made without moving the head away from the eyepiece of the instrument.

Very beautiful drawings of many of the ordinary spectra are given in Lecoq de Boisbaudran's 'Spectres Lumineux.' The means of ignition employed in producing these spectra were (1) the ordinary Bunsen flame, (2) the spark from an induction coil (without a Leyden jar) striking on the surface of the solution of the substance to be examined, (3) the spark impinging on the surface of the fused salt, (4) the spark between metallic wires. In some cases, the gas feeding the Bunsen burner was charged with hydrochloric acid gas, by making the gas pass through a flask containing a warm solution of hydrochloric acid. The spectra drawn comprise the flame-spectra of cæsium, rubidium, and potassium chlorides; barium chloride, bromide, and iodide: strontium, calcium, magnesium, manganese, copper, and gold chlorides; boracic acid and salts of sodium, lithium and thallium; and the spark-spectra of salts of potassium, sodium, lithium, barium, strontium, calcium, magnesium, aluminium, chromium, manganese, iron, cobalt, nickel, zinc, cadmium, indium, tin, bismuth,

[1] *Phil. Mag.* (Fifth ries) vol. v. p. 106.

lead, antimony, copper, silver, mercury, gold, platinum, and palladium, besides absorption-spectra of chloride of didymium, chloride of erbium, and potassium permanganate. Accurate drawings are given by Bunsen[1] of the following spectra:—Flame-spectra of potassium, cæsium, rubidium, thallium, sodium, lithium, calcium, strontium, and barium chlorides; spark-spectra of rubidium, cæsium, thallium, sodium, lithium, calcium, strontium, barium, magnesium, erbium, yttrium, cerium, lanthanum, and didymium; and absorption-spectra of erbium nitrate and didymium sulphate.

It is necessary that the indications of each spectroscope should be reduced to the common scale of wave-lengths, if the results obtained are to be compared with those obtained with other spectroscopes: but for the mere purpose of identifying an alkali or an alkaline earth it is not necessary to go beyond the scale of the spectroscope itself. Photographed scales, giving the positions of lines directly in wave-lengths, to be used instead of the ordinary scale of equal parts, have been constructed,[2] but for accurate work it is much the best to employ a scale of equal parts, and to effect the reduction of wave-lengths separately.

It is not very often that any other means of ignition than the Bunsen flame is employed when the spectroscope is simply used as an addition to the ordinary means of chemical analysis. The employment of a higher temperature, however, much extends its range even for such purposes, and at the same time increases the difficulty of identification, and necessitates more exact measurements.

A small induction coil, actuated most conveniently by some form of battery, such as the Bichromate cell, which can be kept always ready,[3] and a small Leyden jar—the inside coating connected by an insulated wire with the one terminal of the coil, and the outside coating with the other—furnish a spark of the necessary intensity. If platinum wires are employed as poles, it is important that fresh wires should be taken each time, since wires which have been used for any particular metal often continue to give the lines of that metal with great persistency.

Bunsen[4] recommends as poles little cones of pure porous carbon, impregnated with a solution of the substance under examination. A further[5] difficulty in the employment of the spark with the spectroscope for the ordinary purposes of chemical analysis arises from the constant presence of the air-spectrum. It is necessary, therefore, to carefully map the spectrum of air[6] as obtained with the coil and spectroscope, which are to be employed, say, first with platinum wires and then with silver wires as poles. In each case the brightest lines will be those due to air, with the addition in the one case of the fine lines of platinum, and in the other of those of silver. The fine lines given by the less volatile metals

[1] *Pogg. Ann. der Physik u. Chemie*, clv. 366. *Phil. Mag.* (Fourth Series), vol. i. p. 527.

[2] *Roscoe and Schorlemmer's Chemistry*, vol. ii. pt. ii. p. 471. Salet, *Paris Chem. Soc.*, May 4, 1877.

[3] Bunsen, *Phil. Mag.* (Fourth Series), vol. i. p. 527.

[4] *Phil. Mag.* (Fourth Series), vol. i. p. 430.

[5] For other modes of procedure see Lockyer's *Studies in Spectrum Analysis*, pp. 60 and 63.

[6] Maps of the air-spectrum are given in Bunsen's paper, *Phil. Mag.* (Fourth Series), vol. i., and in Thalén's *Détermination des Longueurs d'Onde*.

are often easily distinguished from those of air by the fact that they often extend only a short distance from each pole, and do not reach across the whole breadth of the spectrum, while those of air are of equal width across the whole breadth of the spectrum.

The air-lines are fainter when no jar is employed, so that with the more volatile metals it is easier to work with the coil without a Leyden jar.

The best map of the bright lines of the metals is that of Thalén[1] (upon the scale of wave-lengths), who, however, has employed poles of the metals themselves and higher coil-power than is likely to be used in ordinary laboratory work.

Other modes of ignition, which, however, will be employed for the most part only for special researches, are furnished by the oxy-hydrogen blowpipe and by the electric arc. The differences in the spectra obtained by employing these different methods of ignition may be shortly accounted for by the different temperature to which the substance is heated—at low temperatures the spectra of compounds are obtained which at higher temperatures are resolved into their elements. The Bunsen flame gives the lowest temperature, the oxy-hydrogen flame next, then the spark from a small coil without a Leyden jar; then comes the electric arc, the temperature of which increases with the number of cells employed; then the spark obtained with an induction coil and small jar, the temperature of which is increased up to the highest point obtainable by increasing the size of the coil and jar employed.

The following list of lines will be found useful in constructing the curve of wave lengths for a one-prism spectroscope. The wave-lengths are given in tenth-metres[2] (or ten-millionths of a millimetre); there is also given the approximate position of the line on Bunsen's scale, and the reciprocal of the wave-length, or 'oscillation-frequency'—*i.e.* the number of waves in one millimetre. There are many advantages in using these 'frequencies' instead of the wave-lengths themselves, as will be afterwards explained.

(*a*) *Flame Spectra.*

	Scale-number.	Wave-length.	Oscillation-frequency.
Lithium	31·8	6707·3	1490·9[4]
Sodium	50·0	5896·8, 5890·7 Mean 5893·7	1695·84, 1697·58 Mean 1696·7
Thallium	67·8	5351·1	1868·8
Magnesium[3]	74·5	5184·2	1928·94
Strontium	105·5	4609·0	2169·7

[1] *Nova Acta Reg. Soc. Sc. Upsal.*, Third Series, vi. Upsala. W. Schultz, 1868.

[2] A 'tenth-metre' is $(\frac{1}{10})^{10}$ metre.

[3] Least refrangible line of the (*b*) group, seen in the flame of burning magnesium.

[4] The lines of which the oscillation-frequency is given to two decimal places are found in Ångström's map, and in the B.A. catalogue of oscillation-frequencies; those which have only one decimal place are given on the authority of Thalén. His numbers have been corrected for the small differences between his tables and the table given in Ångström's work ('Recherches sur le spectre solaire,') p. 31, and also for the dispersion of air so as to give the wave-lengths in vacuo. All the numbers in the above table refer therefore to the vacuum.

(*b*) *Fraunhofer Lines.*

	Scale-number	Wave-length	Oscillation-frequency
A	17·5	7606·1	1314·74
B	28·9	6869·1	1455·82
C	35·0	6563·9	1523·48
D	50·0	5896·8 5890·7 } Mean 5893·7	1695·84 1697·58 } Mean 1696·7
E	70·9	5270·6	1897·31
b_1	74·5	5184·2	1928·94
b_2	74·8	5173·6	1932·89
b_3 and b_4	75·0	5169·1	1934·56
F	90·0	4862·1	2056·73
G	127·3	4308·5	2321·02
H_1	161·2	3969·2	2519·39
H_2	165·7	3934·1	2541·88

(*c*) *Spark Spectra.*

Cadmium	36·9	6440·1	1552·76
Lithium	44·6	6103·9	1638·37
Copper	53·2	5783·0	1729·21
Lead	58·4	5608·7	1782·9
Cadmium	66·5	5379·6	1858·9
„	68·2	5339·1	1873·0
Copper	69·9	5293·3	1889·18
„	73·1	5218·7	1916·17
„	75·6	5154·1	1940·19
„	77·8	5106·5	1958·29
Cadmium	78·7	5086·6	1966·0
Air	82·4	5006·6	1997·4
„	82·7	5003·6	1998·6
Barium	86·2	4934·9	2026·37
Cadmium	100·8	4678·3	2137·56
Barium	108·8	4554·8	2195·49
„	110·8	4525·7	2209·58
Calcium	135·5	4227·5	2365·44
Barium	147·1	4131·9	2420·2
Calcium	161·2	3969·2	2519·39
„	165·7	3934·1	2541·88

If the observer is not familiar with the Fraunhofer lines, or has difficulty in recognising the particular bright lines of the metals given in the preceding list, the following plan is recommended: First observe accurately the positions of the lines of the 'flame spectra' given, and from these construct an interpolation-curve; then mark on the curve the wave-lengths of the Fraunhofer lines, and so determine their positions approximately on the scale of the spectroscope. On directing the instrument to the sun or to a bright cloud, the Fraunhofer lines will certainly be found at or near these positions. Now let these Fraunhofer lines be read off as exactly as possible, and from their positions, and those of the lines of the flame-spectra, let a more accurate interpolation-curve be drawn, and let this curve be used to find the positions of the lines of the spark-spectra. The final curve should be drawn when the positions of these spark-lines have been carefully observed. If it is not convenient to make use of the spark-spectra, a very fair curve may be constructed from the lines of the flame-spectra and from the Fraunhofer lines, but a little trouble in obtaining as accurate a curve as possible will be well repaid. As a sample of what may be done with a one-prism spectroscope and reflected scale, the follow-

ing numbers, taken from Lecoq de Boisbaudran, for the wave-lengths of bismuth lines, are compared with Thalén's numbers:—

Lecoq de Boisbaudran	Thalén	Lecoq de Boisbaudran	Thalén
6130	6129·0	5144	5143·5
6048	6050·0	5123	5123·5
5719	5716·5	4724	4722·0
5552	5553·0	4303	4302·0
5268	5270·0	4259	4259·5
5209	5208·0	4118	4119·0

The lines from which Lecoq de Boisbaudran's interpolation-curve was drawn are the following:—

	Scale-reading	Wave-length		Scale-reading	Wave-length
Potassium	65·55	7680	Thallium	118·40	5349
Solar A	72·50	7185	Silver	124·40	5208
Solar B	77·81	6867	Cadmium	130·03	5085
Lithium	80·78	6706	Hydrogen	141·75	4861
Hydrogen	83·71	6562	Cadmium	152·83	4677
Cadmium	86·25	6438	Strontium	157·60	4607
Zinc	88·00	6361	Iron	174·28	4383
Lithium	94·15	6102	„	180·80	4307
Sodium	100·00	5892	Calcium	188·25	4226
Copper	103·25	5781	Indium	200·83	4101
„	105·90	5700	Calcium	216·33	3968
Lead	109·00	5607	„	220·75	3933
Silver	114·00	5464			

The curves of the figure illustrating this report are drawn from the same data.

The different methods of measuring the positions of the lines of a spectrum may conveniently be put into two groups, which may be called methods of consecutive coincidences, and methods of simultaneous coincidences. The chief plans employed are the following:—

'Consecutive Coincidences.'

(1) The graduated arc and vernier.
(2) The tangent-screw micrometer.
(3) The bright line micrometer.

'Simultaneous Coincidences.'

(4) The reflected scale.
(5) The double-wire micrometer eyepiece.
(6) The divided-lens micrometer.
(7) The photographic method.

It is not necessary to remark that some methods are more suitable for a small spectroscope, and others for a large one, and again, that a particular method may be employed in one case and not in another; for example, cross-wires can be employed with the solar spectrum or with any spectrum of sufficient brightness, while they are useless with very faint spectra.

A favourite plan with the opticians is that of the divided arc and vernier, in which the telescope carries cross-wires, the intersection of which is brought to coincidence first with one line, then with a second,

and so on. This of course is a method of 'consecutive coincidences,' and it is a necessary condition of obtaining correct results that the collimator and slit shall remain rigidly in the same position and that the cross-wires of the telescope and the vernier shall retain the same relative position during the motion from one line to another. These conditions are attended to in the massive construction adopted by Steinheil and some other continental makers, but are fatally disregarded when the instrument is constructed of slender metal, and when the collimator and observing telescope, instead of being firmly grasped at the centre of gravity, are merely screwed by one end into a slender upright of brass, further weakened at the most important point by being attenuated into some (so-called) ornamental shape. Certain precautions must be observed in the use of a spectroscope with cross-wires to obtain good results. The eyepiece should first be removed and so adjusted that on looking through it at a sheet of white paper, the cross-wires are seen in sharp focus, then replacing the eyepiece in the observing telescope removed from the spectroscope, the telescope should be exactly focussed on a distant object. Having replaced the telescope in the instrument, the *collimator* should then be adjusted till some lines in the green—say *b* in the solar spectrum—are in accurate focus. The instrument is then in adjustment.[1] When used on the red or blue portion of the spectrum, the focus may be adjusted with the observing telescope, but the collimator should not be altered.

It is necessary that the ray to be measured should be in exact focus together with the cross-wires. If this is not the case, the ray will alter its position slightly with reference to the cross-wires, if the eye be slightly moved. The adjustment may therefore be tested by moving the eye slightly and observing whether the ray and the cross-wires move together. There is also a slight movement of the rays consequent on lateral shifting of the source of light; this is less the narrower the slit is, and the more distant the source of light is.

Some instruments are provided with a tangent-screw micrometer,—that is, a long screw, the head of which is divided into a hundred equal parts, by means of which a slow motion can be given to the observing telescope, and the number of turns of the screws, and parts of a turn necessary to carry the cross-wires from one line to another, is noted.

In the bright-line micrometer[2] the image of a fine slit in a brass plate is seen by reflexion at the first surface of the prism, and so is superposed upon the spectrum; the plate and slit have a slow motion given by a micrometer screw. This form of micrometer is specially useful with very faint spectra, when cross-wires would be useless. In observing with cross-wires a luminous spectrum the lines of which are faint, it is necessary to admit a certain amount of light into the observing telescope, sufficient to illuminate the wires (conveniently by raising an edge of the cloth used to cover up the prisms). This general light renders very faint lines invisible. In all these methods of consecutive coincidences it is necessary that no shifting of the parts of the instrument by bending or shaking, nor any disturbance of the position of the source of light, nor of the exact

[1] For a different method of adjusting the collimator of a spectroscope, see a paper by Dr. Schuster, *Phil. Mag.* [5] vii. 95.

[2] *Microscopical Journal*, January 1870.

position of the eye, should take place during the passage of the cross-wires from one line to the next. In the methods of 'simultaneous coincidences' all these sources of error are avoided by observing at the same instant two lines—one a known line, used as a reference line, and the other the line to be measured.

The method of the reflected photographed scale, already described at some length, may be employed as a method of simultaneous coincidences, and so made more exact if, when the reading of any line is noted, care be taken to observe that the sodium-line is still exactly at 50; or if the sodium-line is not in the field, then that some other line used as reference line is exactly in its right position at the moment of observation.

The most accurate measuring instrument for use with large spectroscopes is the bifilar micrometer eyepiece. This is an eyepiece similar to those employed for astronomical purposes, provided with two crosses of fine spider-lines in the focus of the eyepiece, which must therefore be of the Ramsden construction. One of these cross-wires remains fixed; the other is moved by means of a micrometer screw. The interval between the line to be measured and a line of known wave-length can thus be determined with great precision. In taking an observation, a slight motion is given to the fixed cross-wires by means of the slow motion or tangent screw of the observing telescope, the micrometer screw of the eyepiece being at the same time adjusted by the other hand, till the observer is satisfied that each line is truly coincident with the intersection of the corresponding spider-lines.

Another device for measuring the interval between two lines, quite equal in accuracy to the bifilar micrometer, is that of the divided-lens micrometer.[1] In this instrument the micrometer screw moves one-half of a lens placed just in front of the prisms, and divided along a horizontal diameter. The effect is to cause one-half of the spectrum to move along under the other half, and the sodium or any other convenient line is used as a substitute for the cross-wires, and is brought into coincidence with each of the lines to be measured. It will be seen that the necessity of admitting extraneous light to illuminate cross-wires is avoided, and this instrument can therefore be used in faint spectra with precision.

The photographic method is, of course, a method of simultaneous coincidences, inasmuch as the positions of the known lines which are employed as reference lines are recorded at the same instant as those of the unknown lines.

The bifilar or the divided-lens micrometer may have fitted to it a device for mapping the spectrum at the same time that the positions of the lines are measured. For this purpose the steel rod on which the screw of the micrometer is cut is made about three times as long, and the extra length has cut on it a much coarser thread. On this there travels a little brass piece carrying a steel point, with which a trace can be made on a slip of blackened glass. We thus obtain a mark on the blackened strip of glass corresponding to each line of the spectrum. The map so made has the defect of representing all lines, whether intense or weak, exactly alike; but it would be easy to alter it, so as to limit at pleasure

[1] *Phil. Mag.* August 1875. *Proc. Physical Society*, vol. i. p. 160.

the length of stroke of the tracing point. A bright line would then be denoted by a long trace, and a weak line by a short one. The same instrument might easily be made available for measuring the positions of the lines in the photograph of a spectrum, since, of course, to take a photograph of a mass of lines in a spectrum is not to have measured the wave-length of these lines, or to have determined their chemical origin.

Another instrument—very useful in measuring photographed spectra, or in drawing maps of spectra from measurements—is Beckley's spectrograph. This consists of a brass cylinder, on which the photograph is stretched, and the edge of the cylinder is graduated and provided with a vernier. There is also a straight edge, which can be brought down upon the photograph parallel to the lines of the spectrum. Each line in succession is brought up to the straight edge, and the position of the cylinder is read off by means of the vernier. The instrument is generally graduated into degrees and minutes, but it is desirable that it should carry also (on the other edge) a division into millimetres, the vernier reading to the tenth of a millimetre. The accuracy of reading is increased by substituting for the straight edge a small microscope with a 3-inch objective, and with cross-wires in the eyepiece.

We have already remarked the necessity of reducing the numbers—by whatever instrument obtained—to a uniform scale.

The scale to be employed must be applicable to all spectroscopes alike, and must be independent of the peculiar construction of the instrument—the number, position, and refracting angle of the prisms, the dispersive power of the material of which they are made, of variations in the temperature, and of all other disturbing causes. It is clear that in such a method each line can be mapped only by means of its colour, that is to say, by the length of the wave of light by which it is produced; and a spectrum so represented must be such a one as is produced by *diffraction*, and not by dispersion. Dispersion-spectra obtained by the use of prisms of different materials vary greatly in the relative breadth of the colours, so that in mapping a spectrum it is by no means sufficient to give the positions of only two or three lines as points of reference. Many otherwise valuable observations of spectra are entirely useless from the insufficient number of reference lines observed.

Three spectroscopes (each with a single prism and reflected scale), constructed by Duboscq and intended to be exactly alike, differed as shown in the following table. The numbers show the difficulty of constructing two instruments with exactly similar scales:—

Lines observed	Spectroscope[1] No. 1	No. 2	No. 3
Potassium	65·6	64·0	68·0
Lithium	80·8	80·0	81·5
Sodium	100·0	100·0	100·0
Thallium	118·4	119·0	117·5
Strontium	157·6	160·0	152·5
Rubidium	189·9	195·0	183·0
Potassium	207·4	214·0	198·0

In a *diffraction*-spectrum the position of the lines is dependent solely

[1] *Spectres Lumineux*, p. 4.

on their colour, and is precisely the same by whatever method the spectrum is obtained.

The following table shows the relative positions occupied by the Fraunhofer lines B D E F G in dispersion-spectra, produced by prisms of 60° of crown glass, of flint glass, and of carbon disulphide, with which are compared the positions of the same lines in a spectrum produced by diffraction. The interval between B and G is in each case divided into 1,000 equal parts.

	Dispersion			Diffraction
	Crown Glass	Flint Glass	Carbon Disulphide	
B	0	0	0	0
D	236	220	194	381
E	451	434	400	624
F	644	626	590	784
G	1000	1000	1000	1000

It will be noticed that the blue end of the spectrum is more compressed in the diffraction-spectrum than in any of the dispersion-spectra, and the red end is correspondingly lengthened out.

In order that the results obtained by different observers may be comparable, either the spectra must be obtained directly by the method of diffraction, or the results obtained with the prism must be *reduced to wave-lengths.*

The admirable determinations of the wave-lengths of the chief solar lines which we owe to Angström, will of course form the basis of the reduction to wave-lengths, or when more convenient the measurements based upon them of the bright lines of metallic spectra made by Thalén. In the choice of reference-lines regard will of course be had to the accuracy of the measurements, since the wave-lengths of all lines are not known with equal accuracy.

If the wave-lengths are to be determined accurately to five figures, it is desirable to use as reference lines those only which are found in Angström's map, or in the B. A. map of oscillation-frequencies.

The wave-length of the line to be measured may be calculated from those of two known lines between which it falls by means of the formula:

$$\lambda_2^2 = \frac{n_3 - n_1}{\frac{n_2 - n_1}{\lambda_3^2} + \frac{n_3 - n_2}{\lambda_1^2}}$$

where n_3 and n_1 are the readings on the scale of the spectroscope of the two known lines, λ_3 and λ_1 their wave-lengths, n_2 the reading of the line to be measured, and λ_2 its wave-length. It is desirable that the two known lines should be as close to the one to be measured as possible; when sufficiently close the above formula gives the same result as a simple proportion.

To give an idea of the accuracy of the results obtainable by use of the above formula we may suppose the problem to be to determine the wave-length of a certain strontium line from the wave-lengths of the following three pairs of lines between which it lies. The actual wave-length of the

line in question, as given by Thalen (corrected), is 5533·64. The scale-readings are Kirchhoff's :—

Case 1.	$n_1 = 1274{\cdot}2$	$\lambda_1 = 5534{\cdot}21$	Here the formula and simple proportion both give $\lambda_2 = 5533{\cdot}60$.
	$n_2 = 1274{\cdot}7$		
	$n_3 = 1276{\cdot}2$	$\lambda_3 = 5531{\cdot}77$	
Case 2.	$n_1 = 1268{\cdot}0$	$\lambda_1 = 5542{\cdot}10$	The formula gives 5534·00, and a simple proportion gives 5534·01.
	$n_2 = 1274{\cdot}7$		
	$n_3 = 1281{\cdot}3$	$\lambda_3 = 5526{\cdot}05$	
Case 3.	$n_1 = 1242{\cdot}6$	$\lambda_1 = 5571{\cdot}82$	Here the formula gives 5533·82, and a simple proportion 5534·22.
	$n_2 = 1274{\cdot}7$		
	$n_3 = 1306{\cdot}7$	$\lambda_3 = 5496{\cdot}74$	

But a far more convenient plan, and one quite equal to the above in accuracy, is that of *graphical interpolation*, which has also the great advantage of enabling us to detect at once any reading inconsistent with the rest, so giving the best mean result of all the observations.

A scale of wave-lengths is marked off along one edge of a sheet of paper ruled into squares (inches and tenths or millimetres), and the edge at right angles to this has a scale marked on it corresponding to the scale of the instrument. The positions of as many lines as can be ascertained with precision are mapped on the paper, and a smooth curve is then drawn through all these points, or through as many as possible, and having the rest as near the curves as possible, and as many above as below. In this way one observation is corrected by another, and the curve is more likely to give correct results than an irregular line made up of many straight portions which would pass through all of the points. The position of a line to be measured being found on the curve, will have opposite to it the wave-length sought. Various devices may be employed to facilitate the drawing of the curve. A smooth thin steel rule, which can be bent by the hands into the curve required, will be found useful. It requires, however, the co-operation of two persons—one to hold the rule down on the paper (stretched on a drawing-board), and the other to rule the curve with a finely pointed hard pencil. The author of this report employs a little drawing instrument consisting of a steel bar, mounted on a brass base which rests on the paper. By means of clamping-screws the steel bar can be held bent in the required curve, whether of equal curvature throughout its length, or more curved in one part than another.

A somewhat different method of procedure is described in a paper by Mr. Wm. Dodgson in the sixth volume of the third series of the 'Memoirs of the Literary and Philosophical Society of Manchester.'

The best paper for the purpose is a paper ruled into millimetres and centimetres made in rolls 69 centimetres broad, which may be obtained through Messrs. Williams and Norgate, 14, Henrietta Street, Covent Garden, or a somewhat similar paper to be obtained from Messrs. Lechertier, Barbe and Co., of 60, Regent Street. These papers are more uniform and free from shrinkage than any others. Another paper also ruled in millimetres, in sheets 1 metre by 7 decimetres, is to be obtained from C. Dupressoir, Rue St. Honoré, 175, Paris. A paper, ruled in inches and tenths, 24 inches by 15 inches, is to be obtained from Waterlow and Sons, 60 and 61, London Wall, but it is hardly uniform enough for the

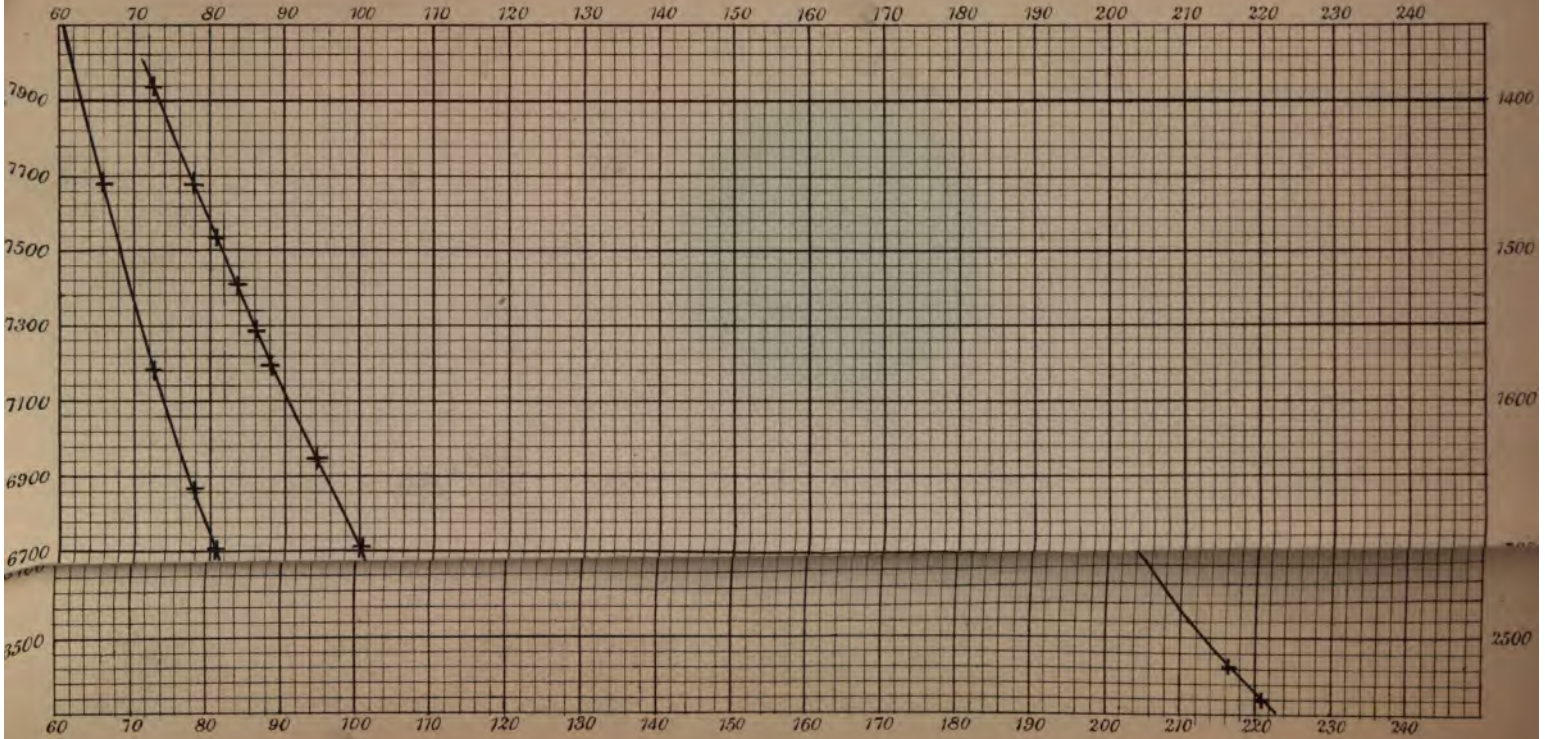
purpose. Some trouble expended in drawing a good curve will be very well repaid. The line obtained in this way will generally be very much curved, but the less curved it is the more easily is it drawn and the more exactly can it be employed. A less curved line is obtained by using the reciprocals of the wave-lengths instead of the wave-lengths themselves.[1] The adoption of this scale of inverse wave-lengths or of oscillation-frequencies is strongly recommended by a Committee of the British Association, under whose superintendence a catalogue[2] of oscillation-frequencies and a corresponding map of the Fraunhofer lines have been prepared. It is hoped that this catalogue will be extended to the bright lines of metals not present in the sun's atmosphere.

The map of oscillation-frequencies is intermediate between a diffraction-spectrum and a dispersion-spectrum, the red end being less extended when compared with the blue end than in Ångström's map, and more extended than in Kirchhoff's. A map drawn to wave-lengths is too much distorted to be advantageously employed with a dispersion-spectroscope, and, on the other hand, a spectrum mapped with a dispersion-spectroscope does not sufficiently resemble the same spectrum seen with a diffraction-spectroscope; but a map of oscillation-frequencies, being intermediate between the two, is not so different from either but that it is suitable for use both with diffraction-spectroscopes and with dispersion-spectroscopes. Further rays which are harmonically related are represented in the map of oscillation-frequencies by equidistant lines and in the catalogue by an arithmetic series whose common difference is equal to its first term. The map accompanying this report shows the scale of a one-prism spectroscope reduced both to wave-lengths and to oscillation-frequencies. It will be seen that the second line is much less curved than the first.

[1] If the *squares* of the reciprocals be employed the interpolation curve will be very nearly (but only *nearly*) a straight line.

[2] *British Association Report*, 1878, Dublin Meeting.

Plate I.



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WAVE-LENGTH TABLES OF THE SPECTRA OF THE ELEMENTS.

Air.

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Spark Spectrum or Elementary Line Spectrum					Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran *a*	Huggins *b*	Kirchhoff *c*	Thalén *d*	Hartley and Adeney *e*		
6606	6602N	6603·1	6602·3		4s	15141*cd*
6560H	6562H	6562·1	6562·1		7s	15235*cd*
6482	6482N	6479·9	6479·8		5s	15428*cd*
6171	6171NO	6171·1	6170·7		5s	16200*cd*
	5950N	5949·6	5949·2		4s	16803*cd*
55535	5942N	5940·2	5941·6		10n	16827*cd*
	5930N	5931·9	5932·1		10n	16853*cd*
	5925N	5929·2	5929·6		4s	16860*cd*
	5768N		5767·1		4s	17334*d*
	5746N		5745·1		4s	17401*d*
	5726N				1s	17459*b*
5711	5709N	5710·8	5711·1		4s	17505*cd*
	5686N	5685·6	5685·6		4s	17583*cd*
β 5685	5680N	5678·1	5678·1		10n	17606*cd*
β 5666	5675N	5674·6	5674·6		6s	17617*cd*
	5668N	5666·6	5666·1		10n	17643*cd*
	5550N		5549·1		4s	18016*d*
	5541N		5541·1		6s	18042*d*
5534	5534N		5534·1		8n	18065*d*
	5528N		5530·1		6s	18078*d*
	5524N				1s	18098*b*
5492	5495N		5495·1		7n	18193*d*
	5479N		5479·1		6s	18246*d*
	5462N		5461·6		4s	18304*d*
5454	5453N		5453·1		3s	18333*d*
	5350N		5351·1		2s	18682*d*
	5338N		5339·6		2s	18723*d*
	5319N		5320·1		2s	18791*d*
	5205O				1s	19207*b*

AIR—*continued.*

Spark Spectrum or Elementary Line Spectrum					Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran *a*	Huggins *b*	Kirchhoff *c*	Thalén *d*	Hartley and Adeney *e*		
	5190O		5189·6		4s	19265*d*
	5179N		5184·6		5n	19282*d*
γ5177	5176N		5178·1		4s	19307*d*
	5172N		5172·1		2s	19329*d*
	5163O				4s	19363*b*
	5071N				2s	19714*b*
5044	5045N	5043·3	5045·1		8s	19819*cd*
	5024N		5025·1		8s	19894*d*
	5016N		5016·1		6s	19930*d*
	5010N		5010·2		6s	19953*d*
	5007N		5006·7		4s	19967*d*
	5003N	5004·6	5005·2		10n	19974*cd*
α5003	4999N	5000·6	5002·2		10n	19988*cd*
	4993N		4993·7		6s	20019*d*
	4986N		4987·2		6s	20045*d*
	4953O				3s	20184*b*
4941	4943O		4941·2		3n	20232*d*
	4831N				1s	20274*b*
	4925O		4924·5		4s	20300*d*
	4907O		4906·1		4s	20377*d*
	4895N		4895·6		4s	20420*d*
	4892O				4s	20435*b*
	4880N				1s	20486*b*
	4872O				3s	20520*b*
	4866N				1s	20545*b*
	4858N				4s	20579*b*
	4853O				2s	20600*b*
	4849N				4s	20617*b*
4805	4804N		4803·1		8s	20814*d*
4788	4788N		4788·1		8s	20879*d*
	4781N		4779·1		10s	20918*d*
			4712·2		4s	21215*d*
4706	4705O		4706·7		7s	21240*d*
	4699O		4698·2		8s	21278*d*
	4677O		4675·2	4674·2	3s	21388*de*
	4662O		4661·7	4660·2	3s	21449*de*
4648	4648O	4648·9	4649·2	4647·2	6s	21506*cde*
	4640NO	4641·4	4642·2	4641·2	7s	21537*cde*
			4640·2		6s	21544*d*
ε 4633	4629N	4629·8	4630·7	4628·9	8s	21593*cde*
	4621N	4620·7	4621·2	4619·9	5s	21640*cde*
	4613N	4612·8	4613·2	4612·3	5s	21672*cde*
4665	4608N	4606·6	4606·7	4605·6	6s	21703*cde*
	4600N	4601·0	4601·2	4600·1	6s	21729*cde*
	4596O		4596·1	4595·0	4s	21754*de*
	4588O		4590·6	4589·3	4s	21786*de*
	4553N			4553·2	2b	21956*e*
				4543·4	2s	22003*e*
				4530·1	3b	22068*e*
	4533 N			4523·0	2n	22103*e*
	4506 N			4513·7	3s	22148*e*
				4506·6	3s	22183*e*
	4496N				1s	22236*b*
	4490N				1s	22265*b*
	4477N			4476·6	3s	22332*e*

AIR—*continued.*

Spark Spectrum or Elementary Line Spectrum					Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran *a*	Huggins *b*	Kirchhoff *c*	Thalén *d*	Hartley and Adeney *e*		
	4467O			4466·1	3b	22384*e*
				4458·7	3s	22422*e*
4449	4448N	4446·3	4446·6	4446·0	7s	22484*cde*
4434	4437 } N 4422 }		4432·1	4432·6	3b	22553*e*
				4425·9	3n	22588*e*
4417	4416O		4418·1	4415·5	6s	22634*de*
	4414O		4414·1	4413·6	6s	22649*de*
				4402·6	2s	22707*e*
	4398N			4394·9	3s	22747*e*
				4386·3	1s	22791*e*
				4378·0	3s	22835*e*
	4364O		4368·1	4365·8	3s	22893*de*
				4356·4	1n	22948*e*
			4350·5	4350·5	4s	22979*de*
4347	4347ON		4347·5	4348·2	6s	22993*de*
			4346·0	4343·9	4s	22998*de*
			4333·0	4335·9	4s	23075*de*
				4330·8	2s	23083*e*
				4326·9	2s	23105*e*
				4324·6	2s	23117*e*
4318	4318O		4319·0	4318·7	6s	23148*de*
			4316·5	4316·2	5s	23161*de*
				4306·9	2n	23212*e*
				4302·0	2n	23238*e*
				4290·0	2n	23303*e*
	4278O			4275·3	2n	23383*e*
				4274·3	1s	23388*e*
				4265·4	1n	23437*e*
				4253·4	2s	23503*e*
4240	4238N			4240·6	6n	23574*e*
				4236·4	6n	23598*e*
			4230·0	4228 9	6n	23637*de*
				4222·6	2n	23675*e*
				4216·5	2n	23709*e*
	4206N			4206·3	2n	23766*e*
				4197·9	2n	23814*e*
	4190O		4189·5	4189·3	5s	23862*de*
	4183O		4184·5	4185·1	5s	23888*de*
	4170N			4176·8	4n	23935*e*
				4169·2	4n	23978*e*
			4155·0	4157·9	1n	24052*de*
	4149O		4149·0	4152·7	3s	24085*de*
	4142N		4137·0	4145·4	5s	24116*e*
	4130N			4132·5	5s	24191*e*
			4123·0	4123·7	4s	24243*e*
	4117O			4119·0	5s	24271*e*
				4110·9 ?	2s	24318*e*
	4101N			4104·3	5s	24359*e*
				4102·6	5s	24368*e*
	4094N			4096·5	5s	24404*e*
				4092·6	1s	24427*e*
				4084·8	2s	24474*e*
			4075·5	4075·1	6s	24532*de*
	4073O		4074·0		6n	24549*d*
			4071·5	4071·4	6s	24554*de*

AIR—*continued.*

Spark Spectrum or Elementary Line Spectrum					Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran *a*	Huggins *b*	Kirchhoff *c*	Thalén *d*	Hartley and Adeney *e*		
	4069O		4069·5	4069·2	6s	24567*de*
				4063·5	1s	24602*e*
				4057·2	1s	24639*e*
	4038N		4040·1	4041·7	5n	24740*de*
				4034·4	4n	24779*e*
				4025·3	2s	24835*e*
	4000N		3995·1	3994·5	6s	25025*de*
				3988·5	1s	25064*e*
				3983·0	2s	25099*e*
				3972·5	6s	25165*e*
				3967·3	2s	25198*e*
				3954·8	6s	25278*e*
				3944·5	2n	25344*e*
				3939·2	4n	25378*e*
				3932·9	1n	25425*e*
				3929·0	1n	25444*e*
				3918·5	6s	25512*e*
				3911·7	4s	25557*e*
				3892·4	1s	25683*e*
				3881·9	4s	25753*e*
				3863·8	2s	25873*e*
				3856·2	3n	25922*e*
				3850·0	2s	25961*e*
				3841·7	2n	26022
				3839·3	4n	26038
				3831·0	4s	26095
				3804·0	2s	26281
				3791·6	2s	26373
				3782·1	2s	26433
				3771·5	2s	26506
				3759·4	2s	26592
				3753·7	2s	26632
				3749·0	6s	26666
				3739·7	1s	26732
				3726·6	6s	26826
				3712·2	5s	26930
				3639·0	2s	27472
				3613·6	2s	27664
				3609 0	3s	27700
				3595·0	3s	27808
				3589·6	3s	27850
				3583·4	3s	27898
				3576·0	3s	27956
				3560 3	3n	28079
				3550·3?	1n	28155
				3545·2	3n	28198
				3514·3	1s	28454
				3509·0?	1s	28489
				3490·7	3s	28639
				3478·1	2s	28742
				3471·2	3s	28799
				3456·1	1s	28926
				3448·2	1s	28992
				3437·0	6s	29087
				3408·0	5s	29334

AIR—*continued.*

Spark Spectrum or Elementary Line Spectrum Hartley and Adeney *e*	Intensity and Character	Osc. Freq.	Spark Spectrum or Elementary Line Spectrum Hartley and Adeney *e*	Intensity and Character	Osc. Freq.
3389·9	5s	29491	2884·5	2s	34657
3376·9	4s	29664	2880·3	2s	34708
3373·6	2s	29633	2823·1	3n	35411
3370·3	2s	29662	2799·5	2s	35709
3366·7	5s	29694	2748·8	1s	36368
3365·7	5s	29703	2733·2	2s	36575
3353·7	5s	29809	2710·0	2n	36890
3342·7	1n	29907	2598·4	1s	38473
3331·2	6s	30010	2591·8	2s	38571
3329·3	6s	30027	2580·0	2s	38748
3324·7	2s	30069	2522·1	3n	39637
3320·1	3s	30110	2478·1	4s	40340
3313·3	1s	30172	2463 0	1n	40588
3307·1	1s	30229	2453·8	2s	40739
3301·1	1s	30284	2445·2	5s	40883
3289·9	2n	30387	2433·6	5s	41078
3274·2	2n	30533	2423·8	3n	41244
3265·2	3s	30617	2418·6	2s	41333
3259·9	3s	30666	2416·2	1s	41374
3219·7	1s	31049	2411·7	1s	41450
3157 5	1s	31660	2407·7	1s	41519
3139·3	5s	31844	2398·3	1s	41683
3134·2	5s	31896	2390·7	1s	41814
3122·4	1s	32016	2332·2	1n	42865
3058·5	1s	32686	2318·1	5n	43126
3046·4	2s	32816	2304·4	1s	43382
3042·5	1s	32858	2301·8	2s	43431
3035·0	2s	32939	2298·0	2s	43503
3024·1	3s	33058	2294·2	2s	43575
3016·1	2s	33146	2291·0	1s	43636
3007·0	6s	33246	2289·3	1s	43668
2982 8	3s	33515	2250·2	1n	44427
2959·5	2s	33779	2186·0	1n	45731

NOTE.—All the air-lines are continuous.

Aluminium.

Kirchhoff, 'Abh. Königl. Akad. Berlin,' 1861.
Wüllner, 'Festschrift Bonn,' 1868.
Thalén, 'Nova Acta Reg. Soc. Sc. Upsal' (III.) vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Lockyer, 'Phil. Trans.' clxiii. 369, 1873.
Liveing and Dewar, 'Proc. Roy. Soc.' xxviii. 367; 'Phil. Trans.' clxxiv. 220, 1883.
Cornu, 'Spectre normal du Soleil,' Paris, 1881; 'Arch. des Sc. Geneve,' July 15, 1879.
Hartley and Adeney, 'Phil. Trans.' clxxv. 101, 1884.
Becquerel, 'Compt. Rend.' xcvi. 1218; xcvii. 72.

I. Spark Spectrum				II. Arc Spectrum	Intensity and Character		Osc. Freq.
Lecoq de Boisbaudran *a*	Thalén *b*	Kirchhoff *c*	Cornu *d*	Liveing and Dewar *e*	I.	II.	
	†6371·3				6sd		15691*b*
	†6344·8				6sd		15756*b*
6244	*6244·2(3)	6244·6		(6244·2)	8nc		16010*bc*
6233	*6234·2(3)	6233·8		(6234·2)	8nc		16036*bc*
	*5722·6(1)	5722·3			10sc		17470*bc*
	*5695·6(1)	5696·1			10sc		17553*bc*
5591	*5592·7(1)				4nc		17875*b*
	*5056·6(1)				10nc		19770*b*
Bands	*4662·2(1)	4662·1			10nc		21443*bc*
of Oxide	*4529·6(1)	Hartley and Adeney			6nc		21594*b*
	*4511·1(1)	4511·0			6sd		22161*bc*
	*4478·6(2)	4477·2			6sd		22325*bc*
		4445·2			6sd		22489*c*
3962	‡3961·1(4)	3960·9	3960·5	(3961·1)	9sc	r	25240*bcd*
3943	‡3943·1(4)	3943·4	3943·2	(3943·1)	9sc	r	25352*bcd*
	Liveing and Dewar	3713·4			6sd		26921*c*
		3701·6			5sd		27007*c*
	3605	3612·6			9sd		27672*c*
	3598	3601·2			9sd		27760*c*
	3585	3584·4			9sd		27890*c*
		3091·9	3091·6	3091·5	9sc	r	32335*cde*
		3081·2	3080·6	3080·5	9sc	r	32450*cde*
		3065·0			5sd		32617*c*
		3062·8			5sd		32640*c*
		3058·5			5sd		32686*c*
		3056·4			6sd		32711*c*
		3053·6			5sd		32738*c*
		3049·2			5sd		32786*c*
		2879·9			5sc		34710*c*
		2815·3			9sd		35509*c*
		2659·3		2659·8	5sd	8r	37589*ce*
		2651·2		2652·0	5sd	8r	37702*ce*
		2630·6			9nd		38003*c*
		2574·1		2574·5	7sd	8r	38833*ce*
		2566·9		2567·5	7sd	8r	39141*ce*
				2378·4		8	42031*b*
		2373·3		2373·2	7nd	10r	42122*ce*
		2372·0			7nd		42144*c*
		2370·0			4sd		42180*c*
		2367·2		2366·9	4sd	8	42233*ce*
		2364·5			7nd		42278*c*

ALUMINIUM —*continued.*

I. Spark Spectrum				II. Arc Spectrum	Intensity and Character		Osc. Freq.
Le·oq de Boisbaudran *a*	Thalén *b*	Kirchhoff *c*	Cornu *d*	Liveing and Dewar *e*	I.	II.	
				2268·7		8n	44063*e*
				2263·1		8n	44172*e*
				2257·3		8n	44287*e*
				2216·0			45112*e*
				2210·0		8n	45234*e*
				2205·0		n	45357*e*
			2024·2				49385*d*
			1988·1				50284*d*
			1933·5				51704*d*
			1928·7				51833*d*
			1860·2				53740*d*
			1852 2				53973*d*

* Observed also by Lockyer.
† Not identified by Lockyer; the 'indices' attached to these numbers represent the comparative lengths of the lines as given by Lockyer. ‡ 3960·6 and 3943·0 Lockyer.

NOTE.—Becquerel has observed infra-red bands in the Arc Spectrum of Aluminium at 11280 and 13615.

ANTIMONY.

Kirchhoff, 'Berlin. Akad.' 1861.
Huggins, 'Phil. Trans.' 1864, p. 139.
Thalén, 'Nova Acta Soc. Upsal' (III.) vi. 1868.
Lockyer, 'Phil. Trans.' clxiii. 369, 1873.
Liveing and Dewar, 'Phil. Trans.' clxxiv. 221, 1883.
Hartley and Adeney, 'Phil. Trans.' clxxv. 126, 1884.

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Liveing and Dewar *d*	I.	II.	
7020				5		14241*a*
6840				2		14616*a*
6803				5		14705*a*
6780				5		14745*a*
6742				1		14828*a*
6712				2		14894*a*
6645				2		15044*a*
6513				2		15349*a*
6500				2		15380*a*
6461				2		15473*a*
6392				4		15640*a*
6320				2		15818*a*
6301	†6301·8(1)	6302·1		8sd		15863*bc*
6283				4		15911*a*
6243	†6244·7(2)	6243·9		4sd		16010*bc*
6204	†6209·2(2)			4sd		16100*b*
6189	†6193·5(2)			4sd		16141*b*
6153	†6155·2(2)			4sd		16242*b*

ANTIMONY—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.		Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.	
2527·6		9sc		39551*c*	2297·0		5sd		43522*c*
2519·5		1sc		39678*c*	2294·0		5sc		43579*c*
2518·8		4nd		39701*c*	2288·8		5sc		43681*c*
2514·5		4nd		39757*c*	2280·8		2sd		43834*c*
2509·5		4sc		39836*c*	2278·3		2sd		43879*c*
2506·5		6sd		39884*c*	2277·1		2sd		43902*c*
2500·2		2nd		39984*c*	2271·1		2sd		44018*c*
2490·7		2sd		40129*c*	2263·5		6sc		44166*c*
2489·2		2sd		40161*c*	2243·0		6sc		44470*c*
2485·7		2sd		40217*c*	2243·5		6sc		44559*c*
2480·4		2sc		40303*c*	2234·5		2sd		44739*c*
2479·4		4sc		40319*c*	2231·3		2sd		44803*c*
2477·3		6sc		40354*c*	2230·3		2sd		44823*c*
2476·7		2nd		40363*c*	2229·0		2sd		44849*c*
‖2473·4		2sc		40417*c*	2226·3		4nc		44903*c*
2470·2		2nd		40486*c*	2223·5		2sd		44960*c*
2464·4		2nd		40564*c*	2221·5		4nc		45000*c*
2462·0		2nd		40604*c*	2218·7		4nd		45057*c*
2458·8		2nd		40657*c*	2216·3		4sd		45106*c*
2454·5		2nd		40728*c*	2211·3		2sd		45208*c*
2445·7		2nd		40874*c*	2209·0		4nc		45255*c*
2444·8		6sc		40890*c*	2203·8		2sd		45362*c*
‖2438·0		2sd		41004*c*	2202·2		4sc		45395*c*
2425·7	2426·0	4sc		41210*cd*	2200·3		2sd		45434*c*
2423·0		2nd		41257*c*	2192·6		4sd		45594*c*
2421·5		4sc		41283*c*	2191·6		4sd		45614*c*
2410·3		2sd		41484*c*	2189·3		2sd		45662*c*
2408·3		2sd		41509*c*	2179·0		6nc		45874*c*
2405·3		4nd		41554*c*	2175·8		6nc		45950*c*
2403·8		2sd		41587*c*	2170·1		6sd		46066*c*
2399·9		2sd		41655*c*	2159·4		2sc		46294*c*
2395·3		4sd		41734*c*	2156·0		2sd		46367*c*
2383·2	2383·3	6sc		41946*cd*	2148·8		2sd		46522*c*
2374·3		6sc		42104*c*	2144·4		4nc		46618*c*
‖2370·0		6sd		42180*c*	2142·0		2sc		46670*c*
2361·3		6nd		42337*c*	2139·3		4sc		46729*c*
2360·7		4sc		42347*c*	2135·7		4sd		46807*c*
2353·0		2sd		42486*c*	2126·1		2sd		47020*c*
2350·6		2sd		42530*c*	2122·5		2sd		47107*c*
2334·2		4nd		42829*c*	2118·0		2sd		47221*c*
2331·8		2nd		42872*c*	2110·4		2sd		47369*c*
2329·7		2nd		42911*c*	2104·2		2sd		47508*c*
2325·3		2nd		42992*c*	2096·4		2nc		47785*c*
2322·1		2nd		43051*c*	2086·3		1sd		47916*c*
2316·4	2313·0	4sd	10r	43189*cd*	2075·3		1sd		48169*c*
2311·8	2310·0	7sc		43260*cd*	2064·8		4nc		48414*c*
2306·8		5sc		43337*c*	2050·5		2sd		48752*c*
					2045·3		2sd		48876*c*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Antimony Chloride solution.
† Observed also by Lockyer. ‡ 4710·9 Kirchhoff. § Not identified by Lockyer. ‖ See Tellurium.

Arsenic.

Kirchhoff, 'Berlin Akad.' 1861.
Huggins, 'Phil. Trans.' 1864, p. **139.**
Thalén, 'Nova Acta Soc. Upsal' **(III.) vi. 1868.**
Huntingdon, 'Am. J.,' 22, 214.
Hartley and Adeney, Phil. Trans. **clxxv. 124, 1884.**

Spark Spectrum				Intensity and Character	Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Huntingdon *d*		
6404				1nc	15611*a*
6342				1nc	15763*a*
6252				1nc	15990*a*
6164	6169·7	6170·0		8sc	16203*bc*
6131				1nc	16306*a*
6108	6110·2	6111·2		8nc	16360*bc*
6078				2nc	16448*a*
6020	6021·7	6021·5	6023	4sd	16602*bc*
			6013	?	16626*d*
			5853	?	17080*d*
5839				1nc	17121*a*
			5833	?	17138*d*
			5813	?	17198*d*
5781				1nc	17293*a*
			5743	?	17407*d*
5647	5651·1	5650·3	5653	8nc	17692*bc*
5616				1nc	17801*a*
5590				1nc	17884*a*
5554	5558·1	5556·8	5563	8nc	17992*bc*
5495	5498·1	5497·6	5498	6nc	18184*bc*
5404				1nc	18499*a*
5384				1nc	18568*a*
5324	5331·1	5331·8	5323	6nc	18751*bc*
5287				1nc	18908*a*
			5245	?	19060*d*
5229			5230	5nc	19117*ad*
			5195	?	19244*d*
5162			5163	1nc	19365*ad*
5104			5103	5nc	19592*ad*
			5013	?	19942*d*
4983				2nc	20062*a*
			4941	?	20233*d*
4888				1nc	20452*a*
4732				1nc	21126*a*
	Hartley and Adeney		4623	?	21624*d*
			4593	?	21766*d*
4551	4550·0			3nc	21971*b*
4537	4538·4			3nc	22027*b*
4497	4494·3		4493	8sd	22244*b*
	4474·0			8sd	22344*b*
4464	4466·3		4463	8sd	22383*b*
	4458·7			8sd	22422*b*
	4431·0			8sd	22560*b*
	4415·0			3sd	22642*b*
4369	4368·7			3sd	22883*b*
	4349·0			3sd	22987*b*
4335	4335·2			3sd	23060*b*
	4315·2		4313	3sd	23167*b*

BARIUM—*continued.*

I. Spark Spectrum			II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Lockyer *d*	Liveing and Dewar *e*	I.	II.	
			4264·0(3)			6n	23445*d*
			4241·5(2)			4	23569*d*
			4239·0(2)			4	23583*d*
			4224·0(3)			6	23667*d*
4174	†4165·0(3)		4165·5(4)		8nc	8	24002*bd*
			4131·5(3)			6	24198*d*
4130	†*4130·5(3)		4130·5(5)		10nc	10	24203*bd*
			4087·0(1)			2n	24461*d*
			‡4084·0(1)			2n	24479*d*
			4081·0(1)			2n	24497*d*
			3996·2(3)			6	25016*d*
			3995·0(4)			8	25024*d*
			3992·7(2)	3991·8		4	25041*de*
			3937·2(4)			6	25393*d*
			‡3934·7(3)				25407*d*
			3909·2	3908·5			25575*de*
				3891·0			25693*e*
				3793·5			26353*e*
				3660·7			27308*e*
				3598·7			27779*e*
				3592·8			27825*e*
				3579·1			27931*e*
				3544·0			28208*e*
				3524·5			28364*e*
				3499·2		10r	28569*e*
				3419·3			29237*e*
				3375·6			29616*e*
				3354·8			29799*e*
				3347·7			29861*e*
				3320·9			30103*e*
				3279·8			30480
				3261·0			30656
				3070·3			32570
				2785·1			35894
				2771·0			36076
				2739·0			36498
				2702·0			37000
				2647·0			37767
				2634·5			37946
				2596·7			38499
				2542·7			39316
				2347·0		8	42595
				2335·0		10	42814
				2304·5		8	43380

Spectrum of Barium Chloride solution by Lecoq de Boisbaudran, who gives also [illegible] 4214, α4242, 3905, 5170, β5136, 5105, 5064, 4556.

The numbers attributed to these numbers, and to those in the fourth column, denote the lines as given by Lockyer. ‡ See Iron. § See Strontium.

Beryllium.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Thalén, 'Nova Acta Soc. Upsal' (III.) vi. 1868.
Cornu, 'Spectre Normal du Soleil,' Paris, 1881.
Lockyer, 'Proc. Roy. Soc.' xxvii. 280.
Hartley, 'Jour. Chem. Soc.' xliii. 316; 'Nature,' Nov. 22, 1883.

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character	Osc. Freq.
Thalén *a*	Kirchhoff *b*	Lockyer *c*	Cornu *d*		
4572·1	4571·9				21866*ab*
4488·6	4487·9				22279*ab*
		3904·7			25668*c*
	Hartley				
	3320·1			8s	30108*b*
			3130·4		31935*d*
			3130·1		31938*d*
	3129·9			10n	31939*c*
	2649·4			8s	37733*c*
	2493·2			8s	40096*c*
	2477·7			8s	40347*c*

Bismuth.

Huggins, 'Phil. Trans.' 1864, p. 139.
Mascart, 'Ann. de l'Ecole Normale,' t. iv.
Thalén, 'Nova Acta Soc. Upsal' (III.) vi. 1868.
Liveing and Dewar, 'Phil. Trans.' clxxiv. 222, 1883; 'Proc. Roy. Soc.' xxix. 398.
Hartley and Adeney, 'Phil. Trans.' clxxv 130, 1884.
Becquerel, 'Compt. Rend.' xcvi. 1218; xcvii. 72.

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.	
6808						14684*a*
6590	6599·3			4sd		15147*b*
6571						15200*a*
6499	6492·8			6sc		15397*b*
6125	*6129·2			8nc		16311*b*
6057	6056·7			8nc		16506*b*
6055	*6050·2			4sd		16523*b*
6034	6038·7			4sd		16555*b*
5980						16717*a*
5972						16740*a*
5862	5861·6			8nc		17055*b*
5819	5816·1			6sd		17189*b*
5717	*5716·6			8nc		17488*b*
5656	5655·1			4sd		17678*b*
5552	*5553·1			4sd		18003*b*
5538						18052*a*

BISMUTH—*continued.*

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.	
5449	5450·1			8nc		18343*b*
5394	5396·7			4sd		18524*b*
5357						18661*a*
5271	*5270·1			8nc		18969*b*
5208	*5208·2			10nc		19195*b*
5199	5201·2			4nd		19221*b*
5144	*5143·7			10nc		19436*b*
5124	*5123·7			10nc		19511*b*
5089	5090·1			2nd		19640*b*
5078	5077·6			4nd		19689*b*
4991	4993·1			10sc		20022*b*
4970	*4970·1			2sd		20114*b*
4915						20340*a*
4907	4905·1			4sd		20381*b*
4798	4796·7			4sd		20842*b*
4752	4752·7			2sd		21034*b*
4729	4730·1			2sd		21133*b*
4723	†*4722·1	4724·5	(4722·1)	3sc	r	21165*bc*
4705	4705·1	4707·0		3sd		21243*bc*
	4691·6			4sd		21308*b*
4560	4560·1	4560·0		7sd		21923*b*
4476		4477·0		3sd		22330*c*
4389		4391·0		3sd		22767*c*
4338	4339·5	4339·4		5sd		23037*bc*
4329	4327·5	4328·7		5sd		23098*bc*
4301	*4302·0	4301·5		9b'd		23240*bc*
		4271·3		7sd		23405*c*
4259	*4259·5	4259·2		9sd		23471*bc*
4120	*4119·0	4121·2	(4119·0)	7sc		24264*bc*
4080	4084·5	4079·0		7sd		24492*bc*
		3863·7		7sd		25874*c*
		3848·5		5sd		25976*c*
		3845·4		3sd		25997*c*
		3815·9		3sd		26199*c*
		3810·5		5sd		26236*c*
		3792·7		9nc		26359*c*
		3780·6		5sd		26443*c*
		3757·0		7sd		26609*c*
		3732·7		3sd		26782*c*
		3711·0		3sd		26939*c*
		3704·0		5sd		26990*c*
		3695·3		9nd		27054*c*
		3684·5		2sd		27132*c*
		3653·9		7sd		27360*c*
		3647·4		2sd		27408*c*
		3631·9		3sd		27525*c*
		3613·8		9nd		27663*c*
		3595·7	3595·3	7sc		27805*cd*
		3541·5		7sd		28228*c*
		3527·9		5sd		28337*c*
		3517·9		2nd		28417*c*
		3510·5	3510·4	7sc		28478*cd*
		3485·0		7nd		28685*c*
		3473·0		7nd		28784*c*

BISMUTH—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.		Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.	
3454·8		3sd		28937*c*	2766·3		7sd		36138*c*
3450·7		7sd		28971*c*	2757·3		2sd		36256*c*
3430·9		7sd		29138*c*	2746·0		3sd		36405*c*
3396·7	3396·2	7sc		29434*c*	2733·2		2sd		36575*c*
3393·2		3nd		29462*c*	2729·3	2730·0	7sc		36625*cd*
3381·9		3sd		29560*c*	2727·1		2sd		36658*c*
3315·3		2sd		30154*c*	2713·1		3nd		36847*c*
3297·9		3sd		30313*c*	2695·6		7sc		37086*c*
3287·4		3nd		30410*c*	2693·2		2nd		37120*c*
§3279·9		3sc		30479*c*	2679·5		2nd		37309*c*
3255·4		2nd		30718*c*	2676·6		2nd		37350*c*
3236·8		3sd		30885*c*	2663·6		1nd		37543*c*
3187·7		2nd		31360*c*	‡2651·8		7sd		37699*c*
3170·0		2sd		31536*c*	2641·4		2nd		37847*c*
3160·0		2sd		31636*c*	2628·3		3sd		38034*c*
3130·8		2sd		31930*c*	2627·0		7sc		38055*c*
3114·8		7nd		32094*c*		2593·0			38553*d*
3110·4		3sd		32140*c*	2583·5		1sd		38686*c*
3075·7		5sc		32503*c*	2581·5		3sc		38725*c*
3067·1	3066·0	10b^{r}c	10r	32601*cd*	2575·5		2nd		38815*c*
3041·3		3sd		32871*c*	§2543·3		3nd		39307*c*
3038·0		7sd		32907*c*	2531·9		3nd		39483*c*
3034·5		7sc		32945*c*	§2529·7		3sd		39518*c*
3023·8	3023·5	10sc		33063*cd*	2523·5	2524·0	7sc		39612*cd*
3009·0		3nd		33224*c*	2514·3	2515·4	3sc		39752*cd*
3001·2	3000·0	2sd		33317*cd*	2503·9		3nd		39925*c*
2992·2	2996·0	7sc		33389*cd*	2500·6		2sd		39978*c*
2988·1		8sc		33456*c*	2499·1		2sc		40002*c*
2982·9		3sc		33514*c*	2489·1		3nc		40161*c*
2973·4		2sd		33621*c*	‡2479·1		3sd		40471*c*
2968·9		2sd		33672*c*	2447·2	2448·0	3sc		40843*cd*
2951·0		3nd		33876*c*	2437·5	2435·5	3sd		41029*cd*
2942·4		2sd		33975*c*	2429·3	2431·0	2sc		41135*cd*
2937·5	2937·4	10sc		34033*cd*	2414·8		9nd		41397*c*
2931·4		3sd		34103*c*	2412·7		2sd		41434*c*
2923·2		2sd		34199*c*	2400·7	2400·8	7sc	10	41641*cd*
2917·5		3sd		34265*c*	2378·0		2nd		42038*c*
2897·2	2897·0	10sc		34507*cd*	2368·0		7sc		42214*c*
2862·5	2862·0	5sc		34927*cd*	2347·0		2nd		42595*c*
2854·8		9nd		35018*c*	2331·8		2sd		42872*c*
2846·1		5sd		35125*c*	2327·0		2b^{r}d		42961*c*
§2840·1		3sd		35199*c*	2325·4		2sd		42990*c*
2832·8		2sd		35290*c*	2321·7		3sd		43059*c*
2822·2		5sd		35422*c*	2317·4		2sd		43139*c*
2816·3		5sd		35496*c*	2313·7		2nd		43208*c*
2808·4	2810·0	7sc		35586*cd*	2310·5		2nc		43268*c*
2805·4		2sd		35634*c*	2301·3		3sc		43440*c*
2802·6		7sc		35671*c*	2297·6		3sc		43510*c*
2798·0	2799·0	3sc		35722*cd*	2294·1		3sc		43575*c*
2784·0		7sd		35908	2291·6		1nd		43622*c*
‖2779·3	2780·0	8sc		35965*cd*	2281·0		2sd		43825*c*
2773·5		3sd		36046*c*	2276·9	2277·0	7sc	4r	43902*cd*
2772·5		3sd		36057*c*	2252·5		2nd		44379*c*

BISMUTH—*continued.*

I. Spark Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	Intensity and Character		Osc. Freq.
Hartley and Adeney *c*	I.	II.		Hartley and Adeney *c*	I.	II.	
2250·5	3sd		44419*c*	2176·6	1nd		45928*c*
2247·0	3sd		44490*c*	2168·5	2nd		46100*c*
2231·4	9nc		44801*c*	2144·3	3nd		46620*c*
2229·1	9nc		44845*c*	2133·8	3nc		46849*c*
2214·8	7sc		45137*c*	2109·8	3nc		47382*c*
2203·3	7nc		45372*c*	2070·2	2nd		48288*c*
2190·4	2nc		45639*c*	2058·2	2nc		48570*c*
2187·0	7nc		45710*c*				

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Bismuth Chloride solution.
† 4721 Mascart. ‡ See Antimony. § See Tellurium. ‖ See Arsenic.
NOTE.—Becquerel has observed infra-red lines in the Arc Spectrum of Bismuth at 9730, 8370, 8250, and 7710,

BORON.

Troost and Hautefeuille, 'Compt. Rend.' lxxiii. 620.
Salet, 'Ann. de Chim. et de Phys.' (4), xxviii. 59.
Hartley, 'Proc. Roy. Soc.' xxxv. 301, 1883.

Spark Spectrum	Intensity and Character	Osc. Freq.
Hartley		
3450·1		28976
2497 0		40035
2496·2		40048

BROMINE.

Plücker, 'Pogg. Ann.' cvii. 527, 1859.
Plücker and Hittorf, 'Phil. Trans.' clv. 24, 1865.
Salet, 'Ann. de Chim. et de Phys.' (4), xxviii. 26.
Ciamician, 'Wien. Ber.' lxxviii. (II.) 874, 1878.

Line Spectrum		Intensity and Character	Osc. Freq.	Line Spectrum		Intensity and Character	Osc. Freq.
Salet *a*	Plücker and Hittorf *b*			Salet *a*	Plücker and Hittorf *b*		
6990		6	14302*a*		6131	2	16306*b*
	6862	6	14569*b*		6128	2	16314*b*
6630	6628	6	15081*ab*	5880	5868	6	17019*ab*
6580	6576	6	15198*ab*	γ5840*	5827	10	17137*ab*
6555	6555	6	15251*ab*		5824	2	17165*b*
α6356	6357	10	15727*ab*		5792	1	17260*b*
β6165	6158	10	16225*ab*		5739	2	17419*b*
	6151	2	16253*b*	δ5720	5722	6	17474*ab*

BROMINE—*continued.*

Line Spectrum		Intensity and Character	Osc. Freq.	Line Spectrum		Intensity and Character	Osc. Freq.
Salet *a*	Plücker and Hittorf *b*			Salet *a*	Plücker and Hittorf *b*		
	5712	2	17502*b*		4990	6	20034*b*
	5696	6	17551*b*		4982	1	20066*b*
	5662	2	17656*b*		4960	2	20155*b*
	5626	2	17769*b*		4945	2	20216*b*
	5622	2	17782*b*	θ4930	4932	8	20274*b*
ε5600	5598	10	17855*ab*		4924	2	20302*b*
	5566	1	17961*b*		4868	1	20536*b*
	5552	1	18006*b*		4852	2	20604*b*
5515	5515	8	18127*ab*		4847	1	20625*b*
5500	5502	8	18173*ab*	μ 4815	4818	8	20756*ab*
5495	5492	8	18198*ab*		4807	2	20797*b*
5450	5446	10	18350*ab*	4785	4787	10	20888*ab*
	5436	10	18390*b*		4778	2	20923*b*
5425	5428	1	18422*ab*		4771	6	20954*b*
	5422	8	18438*b*		4746	1	21064*b*
	5391	1	18544*b*		4736	1	21109*b*
	5383	1	18571*b*		4730	1	21135*b*
5335	5326	10	18754*ab*	4720	4721	4	21178*ab*
	5299	1	18866*b*	ν4705	4706	10	21245*ab*
5310	5292	10	18859*ab*		4695	2	21293*b*
5275	5263	8	18973*ab*	4675	4680	10	21373*ab*
5265	5250	8	19015*ab*		4676	1	21380*b*
ζ 5240	5225	10	19106*ab*		4644	1	21526*b*
	5220	1	19152*b*	4620	4625	10	21627*ab*
	5216	2	19166*b*	4542	4543	4	22008*ab*
	5187	1	19273*b*	4485		6	22290*a*
	5180	2	19299*b*	π4367	4365	10	22897*ab*
5185	5168	10	19312*ab*	4287	4288	2n	23317*ab*
5165	5150	8	19384*ab*	4230	4241	1n	23603*ab*
	5122	2	19518*b*		4228	2	23645*b*
	5106	2	19579*b*	4180	4198	1n	23865*ab*
	5092	4	19633*b*		4181	1	23911*b*
η5060	5054	6	19769*ab*		4142	1	24142*b*
	5035	6	19859*b*	ρ3980			25118*a*
	5010	6	19954*b*				

* Double.

c ?

Cadmium.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Mascart, 'Annales de l'Ecole Normale,' iv. 1866.
Thalén, 'Nova Acta Soc. Upsal' (III.) vi. 1868.
Lockyer, 'Phil. Trans.' clxiii. 369, 1873.
Cornu, 'J. de Phys.' x. 425; 'Archives des Sciences de Genève,' July 15, 1879.
Liveing and Dewar, 'Proc. Roy. Soc.' xxix. 482, 1879.
Hartley and Adeney, 'Phil. Trans.' clxxv. 98, 1883.

I. Spark Spectrum					II. Arc Spectrum	Intensity and Character		Osc. Freq.
Thalén *a*	Kirchhoff *b*	Mascart *c*	Liveing and Dewar *d*	Hartley and Adeney *e*	Liveing and Dewar *f*	I.	II.	
	*6727·0							14861*b*
*‖6466·3(1)	6466·1					6nc		15460*ab*
*‖§6438·3(2)	6438·5	6437·0	6437·7		(6438·3)	10sc	10scr	15528*abd*
*‖6056·7(1)						2sd		16505*a*
*‖6003·7(1)						2sd		16651*a*
*‖5957·7(1)						2sd		16780*a*
*‖5913·1(1)						2sd		16907*a*
‖5790·1(1)						2sd		17266*a*
‖5687·1(1)						4sd		17578*a*
‖5489·1(1)						2sd		18216*a*
‖5471·2(1)						4sd		18276*a*
*‖§5378·2(3)	5378·8	5377·1	5378·0			10nc		18588*abd*
*‖§5337·7(3)	5337·6	5336·3	5337·4			10nc		18729*abd*
*‖5304·6(1)						2sd		18846*a*
*‖§5153·2(1)						4sd		19400*a*
*‖†§5085·1(4)	5084·3	5084·4	5085·3		(5085·1)	10sc	10scr	19660*abd*
*‖†§4799·1(4)	4799·7	4798·6	4799·4	4799·0	(4799·1)	6sc	10scr	20832*abde*
*‖†§4677·0(4)	4677·6	4676·5	4677·6	4676·7	(4677·0)	7sc	10scr	21373*abde*
*‖§4415·6(4)	4415·2	4414·5	4415·0	4414·5	(4415·6)	5sc	6sc	22643*abde*
				4215·3		2sd		23716*e*
				4158·0		2sd		24043*e*
	Cornu			4141·0		2sd		24142*e*
				4127·4		2sd		24221*e*
				4115·2		2sd		24293*e*
		‡3985·6		3987·6		2sd		25070*e*
				3976·3		4sd		25141*e*
				3974·5		4sd		25160*e*
				3940·0		4sd		25373*e*
				3851·0		2sd		25959*e*
				3810·0		2sd		26239*e*
				¶3682·6		2sc		27147*e*
	{3611·7	3607·5	{3612·2	{3611·8		9nc		27678*e*
	{3609·0		{3609·8	{3609·6		10nc		27696*e*
				3535·0		4sd		28280*e*
				3498·2		4nd		28577*e*
	{3466·5	3464·5	{3467·0	{3466·8		8nc		28836*e*
	{3465·5		{3465·6	{3465·4		10nc		28847*e*
	3401·5	3403·0	3403·1	3402·9		10nc		29381*e*
				{3384·7		4sd		29536*e*
		3287·5		{3285·3		2sd		30429*e*
				{3282·9		4sd		30452*e*
				3276·4		4sd		30512*e*
				3264·1		4sd		30626*e*

CADMIUM—*continued.*

I. Spark Spectrum				II. Arc Spectrum	Intensityand Character		Osc. Freq.
orna *b*	Mascart *c*	Liveing and Dewar *d*	Hartley and Adeney *e*	Liveing and Dewar *f*	I.	II.	
258		3260·5	3260·2		7sc		30663*de*
248		3252·1	3251·8		5sc		30743*de*
247		3249·8	3249·5		7sc		30764*de*
			3233·6		2sd		30925*e*
			3222·6		2sd		31021*e*
			3219·9		2sd		31047*e*
			3216·0		4sd		31085
			3211·8		2sd		31125
			3209·0		4sd		31153
			3200·6		2sd		31234
			3196·8		4sd		31271
			3194·9		4sd		31290
			3185·1		7sd		31370
			3181·5		2sd		31422
			3177·9		2sd		31457
			3176·1		2sd		31475
			3172·9		7sd		31507
			3161·0		7sd		31626
			3156·0		4sd		31676
			3152·7		2sd		31709
			3132·5		5sc		31913
			3129·6		7sd		31943
			3123·6		4sd		32004
			3120·9		4sd		32032
			3117·8		6sd		32063
			3112·0		4sd		32123
			3095·0		7sd		32301
			3090·5		2sd		32348
			3087·7		2sd		32377
			3084·3		7sd		32413
			3080·2		4sc		32456
			3076·7		4sd		32493
			3073·2		2sd		32530
			3067·8		6sd		32587
			3064·0		7sd		32627
			3058·4		6sd		32687
			3052·3		6sd		32752
			3048·2		6sd		32797
			3034 9		2sd		32940
			3023·8		2sd		33061
			3016·1		4sd		33146
			3013·8		2sd		33171
			3002·5		2sd		33295
			2994·8		4sd		33381
			2986·1		4sd		33478
			2979·9		7sc		33548
			2970·2		4sd		33658
			2964·5		2sd		33722
			2951·4		2sd		33872
			2947·1		6sd		33921
			2909·9		4sd		34355
			**2880·1		7sc		34710
			2868·0		4sc		34856
			2836·1		7sc		35248

CADMIUM—*continued.*

I. Spark Spectrum				II. Arc Spectrum	Intensity and Character		Osc. Freq.
Cornu *b*	Mascart *c*	Liveing and Dewar *d*	Hartley and Adeney *e*	Liveing and Dewar *f*	I.	II.	
			2833·0		2sd		35287*e*
			2832·3		2sc		35296*e*
			2807·3		2sd		35610*e*
			2804·0		4sd		35652*e*
			2779·8		2sd		35962*e*
			2774·5		2sd		36031*e*
			2766·5		4sd		36135*e*
			2763·1		4sc		36179*e*
2747·7	2743·4		2747·7		9nc		36382*be*
			2726·9		4sd		36661*e*
			2706·0		2sd		36944*e*
			2677·2		4sc		37341*e*
			2658·5		1sd		37604*e*
			2649·4		1sd		37733*e*
			2645 4		1sd		37790*e*
			2639·7		1sd		37873*e*
			2639·5		4sc		37874*e*
			2635·3		1sd		37935*e*
			2632·7		1sd		37972*e*
			2632·3		1sc		37978*e*
			2630·2		1sd		38008*e*
			2629·1		1sc		38024*e*
			2624·8		1sd		38087*e*
			2618·0		4sd		38185*e*
			2614·0		2sc		38244*e*
			2611·0		1sd		38288*e*
			2600·8		1sd		38438*e*
			2598·8		1sd		38467*e*
			2595·3		1sd		38519*e*
			2592·0		1sd		38583*e*
			2587·8		1sd		38631*e*
			2585·0		1sd		38673*e*
2572·3	2574·2	2572·6	2572·2		9nc		38865*bde*
			2568·2		1sd		39002*e*
			2557·4		1sd		39090*e*
			2555·0		1sd		39127*e*
			††2551·6		4sd		39179*e*
			2547·2		1sd		39246*e*
			2544 5		2sc		39288*e*
			2499·6		4sd		39994*e*
			2488·2		4sd.		40177*e*
			2469·3		6sd		40484*e*
			2418·5		4sd		41334*e*
			2377·3		2sd		42050*e*
			2376·6		2sd		42056*e*
			2329·5		7sc		42915*e*
2321 8		2320·9	2321·6		9nc		43064*bde*
2313·5	2318·3	2312·8	2313·6		10nc		43215*bde*
		2306·6	2307·0		8sc		43337*de*
2288·5			2288·9		9nc		43683*be*
			2268·6		4sd		44066*e*
2265·5	2265 0	2264·6	‡‡2265·9		9nc		44131*bde*

CADMIUM—*continued.*

I. Spark Spectrum				II. Arc Spectrum	Intensity and Character		Osc. Freq.
Cornu *b*	Mascart *c*	Liveing and Dewar *d*	Hartley and Adeney *e*	Liveing and Dewar *f*	I.	II.	
			2249·2		4sd		44446*e*
			2241·4		6sd		44601*e*
			2227·0		4sd		44889*e*
			2206·2		4sc		45312*e*
2194·5	2217·1	2194·3	2196·4		8nc		45556*bbe*
2144·1			2146·8		8nc		46566*bc*
			2111·5		2nd		47344*e*

* Observed also by Huggins.
† Observed by Lecoq de Boisbaudran in the Flame Spectrum of Cadmium Chloride and Bromide.
‡ Undoubtedly an air-line. See 'Air'; Thalén 3995, Hartley and Adeney 3994·5.
§ Observed by Lecoq de Boisbaudran in the Spark Spectrum of Cadmium Chloride solution.
‖ Observed also by Lockyer in the Spectrum of the Spark between metallic poles: the 'indices' attached to these numbers denote the relative 'lengths' of the lines.
¶ Origin doubtful. ** See Aluminium. †† See Thallium. ‡‡ See Copper.

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Thalén, 'Nova Acta Soc. Upsal' (III.) vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
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Liveing and Dewar, 'Proc. Roy. Soc.' xxviii. 352, 1879.

I. Flame Spectrum		II. Spark Spectrum		III. Arc Spectrum	Intensity and Character			Osc. Freq.
	Lecoq de Boisbaudran *a*	Thalén *b*	Lockyer *c*	Liveing and Dewar *d*	I.	II.	III.	
	6975				2s			14333*a*
ε	6723				5s			14870*a*
	6602				1n			15143*a*
	6465				1n			15463*a*
	6361				3s			15716*a*
γ	6219				7s			16075*a*
δ	6007				6s			16642*a*
				5990				16689*d*
η	5850				4s			17089*a*
ζ	5662				5s			17656*a*
	5637				5s			17735*a*
	5572				2n			17942*a*
θ	5501				4n			18172*a*
	5464				4n			18295*a*
	5410				3n			18479*a*
	5345				2n			18763*a*
	5310				1n			18827*a*
	5257				1n			19016*a*
		†4971·7				10nc		20108*b*
β	4597		4592 2		9s			21769*c*
α	4560		4554·9	4555·Q	10s		r	21947*cd*

† Probably due to Lithium.—Liveing and Dewar, *Proc. Roy. Soc.*

Calcium.

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I. Spark Spectrum			II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Lockyer *e*	I.	II.	
			6725·9				14863*d*
6710		(6716·2)	6716·2				14884*d*
6498	6498·3	6498·2	6498·3		8sc		15384*bc*
6492	6492·4	(6492·4)	6492·4		10sc		15398*b*
6468	6468·8	6468·9	6468·8		8sc		15454*bc*
6458	*6462 0	(6462·0)	6462·0		10sc		15471*b*
6445	6449·3	6449·7	6449·3		8sc		15500*bc*
6434	*6438·5	(6438·5)	6438·5		10sc		15527*b*
6352							15738*a*
6336							15778*a*
6311							15841*a*
		6206·7					16107*c*
		6193·7					16141*c*
		6177·2					16184*c*
6163	6168·4	6168·8			10sc		16206*bc*
6154	6161·4	(6161·4)			10sc	r	16225*b*
6116	*6121·4	6120·9	6121·4		10sc	r	16332*bc*
	6101·9	6102·1	6101·9		8sc		16383*bc*
6093							16406*a*
6087							16424*a*
6060							16497*a*
6002		6003·1					16653*c*
5986							16701*a*
5854	*5856·6	5857·3	5856·6		6sc		17069*bc*
5600	5601·8	(5601·8)	5601·8		4sd		17846*b*
5598	5600·3	5600·2	5600·3		6sd		17851*bc*
5594	5597·4	5597·2	5597·4		6sd		17860*bc*
5591	5593·6	5593·4	5593·6		8sc		17872*bc*
5588	5589·1	5588·9	5589·1		4sd		17887*bc*
5587	*5587·7	5587·2	5587·7		10sc		17892*bc*
5581	5580·9	5580·9	5580·9		4sd	r	17913*bc*
5509							18147*a*
5318	*5348·8	5347·8	5348·8		8sc		18692*bc*
E5269	*5269·6	5269·7	5269·6		8sc		18971*bc*
5264	5264·7	(5264·8)	5264·7		6sc		18989*b*
	5263·5	(5263·5)	5263·5		4sd		18993*b*
5261	5261·3	5261·7	5261·3		2sc		19000*bc*
5258	5261·0	5261·2	5261·0		2sc		19002*bc*
5187	*5188·4	5188·3	5188·4		6sc	r	19269*bc*
5040	*5C41·3	5041·1	5041·3		8sc		19831*bc*
5021							19910*a*
4877	*4877·6	4878·0	4877·6		6sc	r	20495*bc*

CALCIUM—*continued.*

I. Spark Spectrum			II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Lockyer *e*	I.	II.	
	4848·2		4848·1		4sd		20619*b*
	4831·9				2sd		20690*b*
	4811·7		4811·7		4sd		20777*b*
	4607·7		4607·7		4sd		21696*b*
4584	*4585·5		4585·5		4sd	r	21801*b*
4581	4580·9		4580·9		4sd	r	21823*b*
4578	4578·4		4578·4		4sd	r	21836*b*
	‖4535·6		4535·6		2sd		22041*b*
	‖4534·3		4534·3		2sd		22047*b*
	‖4532·2		4532·2		2sd		22058*b*
	4455·3				2sc		22439*a*
4454	*4454·1	4455·0	4454·1	†4454·2(4)	10sc	8 r	22442*bce*
	4435·4				2sc		22539*a*
4434	*4434·6	4435·2	4434·6	4434·5(4)	10sc	8 r	22542*bce*
4424	*4425·1	(4425·2)	4425·1	4425·0(4)	10sc	6 r	22592*bce*
		4418·9					22623*c*
	§4407·7		4407·7		2sd		22681*b*
	4407·1		4407·1		2nd		22684*b*
	4405·8		4405·8		2sd		22691*b*
	4393·0		4393·0		4sd		22757*b*
	4389·4		4389 4		4sd		22775*b*
	4384·7		4384·7		4sd		22800*b*
	§4379·1		4379·1		4sd		22829*b*
				4354·0(2)		4n	22961*e*
4318	*4318·0	4318·6	4318·0	4318·0(3)	8sc	6 r	23151*bce*
G4306	*4306·5	4306·9	4306·5	4306·5(3)	6sd	6 r	23213*bce*
4302	*4302·3	4301·6	4302·3	4302·0(3)	10sc	6 r	23238*bce*
4298	4298·5	4298·8	4298·5	4298·5(3)	6sd	6 r	23256*bce*
4288	*4289·4		4289·4	4289·4(3)	8sc	6 r	23306*be*
4282	*4282·5		4282·5	4282·4(3)	8sc	6 r	23344*be*
	**4274·5				2sd		23387*b*
	§4271·5				2sd		23404*b*
	**4253·9				2sd		23501*b*
	§4249·8				4sd		23523*b*
	4247·5				2sd		23536*b*
	4237·5			4237·5(1)	2sd	2n	23592*be*
	§4233·0				2sd		23617*b*
4227	‡4226·3			4226·3(5)	12nc	10 r	23654*be*
	††4215·3				8nc		23715*b*
	4192·5				2sd		23845*b*
	4188·5				4sd		23867*b*
	§4143·0				4sd		24130*b*
	§4131·5				4sd		24197*b*
	4098·0			4097·5(2)	2sd	4n	24397*be*
	4095·5			4093·3(1)	2sd	2n r	24416*be*
	4091·8			4091·8(1)	2sd	2n	24432*be*
	††4077·0				6sc		24521*b*
				3972·8(2)		4	25156*e*
3969	H_1*3968·1		3967·7	3967·4(5)	10nc	10s r	25195*bde*
			3972·3				25167d_1^1
			3956·0	3956·0(1)		2s	25270*de*
			3947·9	3947·8			25322*de*
	H_2*3933·0		3933·0	3932·7(5)	10nc	10s r	25419*bde*

CALCIUM—*continued.*

II. Arc Spectrum		Intensity and Character		Osc. Freq.	II. Arc Spectrum		Intensity and Character		Osc. Freq.
Liveing and Dewar *d*	Cornu *e*	I.	II.		Liveing and Dewar *d*	Cornu *e*	I.	II.	
3736·4	3736·5			26756*de*	3224·5			n	31003*d*
3705·5	3705·5			26979*de*	3213·0			n	31114*d*
3644·0			10 r	27434*d*	3208·0			n	31162*d*
3631·0			10 r	27532*d*	3181·0	3181·1			31427*de*
3623·5			10 r	27589*d*	3179·0	3179·0			31447*de*
3486·5			s	28673*d*		3163·5			31551*e*
3474·5			s	28772*d*	3158·8	3158·8			31648*de*
3468·0			s	28826*d*	3151·0			2n	31726*d*
3359·5			10	29758*d*	3141·0			2n	31827*d*
3347 5			10	29864*d*	3136·0			2n	31878*d*
3342·0			10	29913*d*	3117·5			2n	32067*d*
3285·0			s	30432*d*	3108·0			2n	32165*d*
3273·5			s	30539*d*	2398 0			2n	41684*d*
3268·5			s	30586*d*					

Becquerel has observed infra-red bands from 8880 to 8830 and from 8760 to 8580 in the Arc Spectrum of Calcium.

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Calcium Chloride solution.
† The numbers attached as 'indices' in this column denote the comparative 'lengths' of the lines.
‡ 4226 Mascart. § Origin doubtful—probably Iron lines. ‖ Compare Titanium.
** Compare Chromium. †† See Strontium.

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I. Band Spectrum			II. Line Spectrum		Intensity and Character		Osc. Freq.
Watts *a*	Ångström and Thalén *b*	Piazzi-Smyth *c*	Watts *d*	Ångström and Thalén *e*	I.	II.	
			6578	6583·0		10s	15186*e*
			6562	6577·5		12s	15198*e*
*‡†6190	6187·3	6183·4			3b^r		16163*bc*
			6165			4b^v	16216*d*
*‡†6110	6119·0	6116·0			4b^r		16342*bc*
			6095			4s	16402*d*
*‡†6050	6056·3	6054·2			3b^r		16510*bc*
*‡5990	6000·8	5999·7			2b^r		16661*bc*
*‡5955	5953·5	5955·6			1b^r		16789*bc*
			**5954			1s	16790*d*
		††5918·8			1b^r		16890*c*
			**5855				17074*d*
			5688	5694·1		6s	17557*e*
			5652	5660·9		6s	17660*e*
			5640	5646·5		8s	17705*e*
			**5635	5638·6		2s	17730*e*
*‡†‖5634·7	α5633·0	5636·1			8b^r		17742*abc*
	?						
	5604·0				3b^r		17839*b*
	5602·0				3b^r		17845*b*
	5600·0				3b^r		17855*b*
	5597·5				2b^r		17860*b*
	5594·5				2b^r		17869*b*
	5592·0				1b^r		17877*b*
	5589·0				1b^r		17887*b*
	5585·5				0·5b^r		17898*b*
*‡†‖5585·5	β5583·0	5585·5			7b^r		17901*abc*

CARBON—*continued.*

I. Band Spectrum			II. Line Spectrum		Intensity and Character		Osc. Freq.
Watts *a*	Ångström and Thalén *b*	Piazzi-Smyth *c*	Watts *d*	Ångström and Thalén *e*	I.	II.	
	5580·4				7b^r		17915*b*
	5577·2				6b^r		17925*b*
	5574·3				6b^r		17934*b*
	5570·9				5b^r		17945*b*
	5568·3				5b^r		17954*b*
	5564·8				4b^r		17965*b*
	5561·4				3b^r		17976*b*
	5557·6				3b^r		17988*b*
	5553·5				2b^r		18001*b*
	5549·8				2b^r		18013*b*
	5546·1				1b^r		18025*b*
	5542·3				1b^r		18038*b*
*‡†‖5542·3	γ5538·0	5542·1			3b^r		18043*abc*
	?	5539·3			2b^r		18048*c*
		5536·9			1b^r		18055*c*
	5534·5	5534·1			1b^r		18064*bc*
	5530·6	5530·4			0·05b^r		18076*bc*
	5526·7	5527·0			0·05b^r		18088*bc*
	5522·3	5525·0			0·05b^r		18100*bc*
	5517·7	5521·4			0·05b^r		18112*bc*
	5513·6	5517·8			0·05b^r		18125*bc*
	5509·5	5513·3			0·05b^r		18139*bc*
	5504·3	5508·1			0·05b^r		18156*bc*
*‡†‖5503·5	δ5500·0	5492·8			2b^r		18180*abc*
	5496·0				1b^r		18190*b*
	5491·5				0·05b^r		18205*b*
	5486·0				0·05b^r		18223*b*
	5479·5				0·03b^r		18245*b*
	5476·0				0·03b^r		18256*b*
	5471·0				0·03b^r		18273*b*
*‡†5478·4	ε5466·0	5473·0			2b^r		18268*abc*
	5461·0				0·1b^r		18306*b*
	5455·5				0·05b^r		18325*b*
	5450·0				0·03b^r		18343*b*
	5444·5				0·02b^r		18362*b*
*‡5440	?	5448·8			1b^r		18347*c*
*‡5425		5434·8 5423·8	**5426		0·5b^r	4s	18395*c*
			††5385	5379·0		2s	18432*c*
			5306			4s	18575*de*
5165·5	α5164·0	5165·3			10b^r		18845*d*
	?		5152	5150·5		5s	19407*de*
			5140	5144·2		6s	19442*de*
	5144·0				5b^r		19434*b*
	5142·5				4b^r		19440*b*
	5141·0				3b^r		19446*b*
	5139·2				3b^r		19453*b*
	5137·3				2b^r		19461*b*
	5135·5				2b^r		19467*b*
	5133·8				1b^r		19473*b*
				5133·0		3s	19476*e*
	5132·0						19480*b*
	5129·7				1b^r		19489*b*
*‡†‖5130·4	β5128·0	5129·8					19490*abc*

CARBON—*continued.*

I. Band Spectrum			II. Line Spectrum		Intensity and Character		Osc. Freq.
Watts *a*	Ångström and Thalén *b*	Piazzi-Smyth *c*	Watts *d*	Ångström and Thalén *e*	I.	II.	
		5128·3			4b^r		19494*b*
		5126·8			3b^r		19500*b*
		5125·1			2b^r		19506*b*
		5123·6			1b^r		19512*b*
	?	5122·2			0·3b^r		19517*b*
		5120·7			0·4b^r		19523*b*
		5118 9			0·3b^r		19530*b*
		5117·1			0·2b^r		19537*b*
		5115·6			0·1b^r		19543*b*
		5114·1			0·1b^r		19548*b*
		5112·5			0·1b^r		19554*b*
		5111·0			0·1b^r		19560*b*
	5106·3	5108·5			0·1b^r		19574*bc*
	5103·0	5105·7			0·1b^r		19586*bc*
	5100 0	5103·1			0·1b^r		19596*bc*
*‡‖5100·0	γ5097·7	5100·0			3b^r		19609*abc*
		5098·1			1b^r		19609*c*
	5095·5	5095·0			0·3b^r		19620*bc*
	5092·1	5092·3			0·3b^r		19632*bc*
	5089·3	5089·4			0·1b^r		19643*bc*
	5085·9	5086·3			0·1b^r		19656*bc*
		5082·0			0·1b^r		19671*c*
‡5082	5082·4	5079·5			1b^r		19670*b*
	5079·2						19682*b*
		5076·9			0·2b^r		19691*c*
	5076·0	5074·6			0·1b^r		19697*bc*
	5072·7	5071·9			0·1b^r		19709*bc*
	5069·4	5069·0			0·3b^r		19721*bc*
	5066 5	5066·5			0·3b^r		19732*bc*
			††5065			3b^r	19737*d*
	5062·8	5063·0			0·05b^r		19746*bc*
	5059·5	5058·6			0·05b^r		19761*bc*
	5055·6	5055·6			0·1b^r		19774*bc*
	5052·2	5051·9			0·1b^r		19788*bc*
	5048·5	5048·2			0·05b^r		19803*bc*
	5044·7	5043·8			0·05b^r		19819*bc*
	5040·2	5039·8			0·1b^r		19835*bc*
	5036·7	5036·4			0·1b^r		19849*bc*
	5033·0	5032·8			0·03b^r		19863*bc*
	5029·0	5028·0			0·03b^r		19881*bc*
	5024·5	5023·6			0·03b^r		19898*bc*
	5021·5	5019·0			0·03b^r		19914*bc*
	5016·7	5014·7			0·03b^r		19931*bc*
	5012·5	5009·8			0·03b^r		19950*bc*
	5008·5				0·05		19960*b*
	5004·5				0·05		19976*b*
	5000·0				0·05		19994*b*
	4996·0				0·05		20010*b*
	4991·5				0·05		20028*b*
	4987·5				0·05		20044*b*
	4983·0				0·05		20062*b*
	4978·0				0·05		20082*b*
	4973·5				0·05		20100*b*
	4969·0		4969		0·05	2b^r	20119*b*

CARBON—*continued.*

I. Band Spectrum			II. Line Spectrum		Intensity and Character		Osc. Freq.
Watts *a*	Ångström and Thalén *b*	Piazzi-Smyth *c*	Watts *d*	Ångström and Thalén *e*	I.	II.	
	4964·0				0·05		20139*b*
	?		**4960			1b^r	20155*d*
			4947			6s	20218*d*
			4927			5s	20290*d*
			4911			4s	20356*d*
			4900			3s	20402*d*
			4874			1s	20511*d*
			**4860			1s	20570*d*
*‡†‖4739 8	4736·0	4739·6			4b^r		21097*abc*
			**4730			8s	21135*d*
*‡†4717·2	4714·0	4717·7			3b^r		21192*abc*
*‡†4698·4	4697·0	4700·2			2b^r		21277*abc*
			4696			8s	21288*abc*
*‡†4684·2	4682·0	4687·3			1b^r		21347*abc*
*‡†‖4677		4680 2			1b^r		21360*c*
			4674			1s	21389*d*
			4656			1s	21471*d*
			4646			10s	21517*d*
			4637			10s	21559*d*
			4632			8s	21582*d*
			4590			4s	21780*d*
			4585			4s	21803*d*
			4417			6s	22633*d*
		4382·3			0·5b		22812*c*
		4373·2			1b		22860*c*
		4368·7	4368		2b	2b^r	22883*c*
		4364·2			1b		22907*c*
		4359·7			0·5b		22931*c*
		4356·7			0·3b		22946*c*
			4350			2b^r	22982*d*
		4334·4			1s		23064*c*
			**4320			2s	23141*d*
*‖‡4313	4311·0	4316·7			5b^r		23159*c*
?		4308·7			3b^r		23202*c*
		4305·7			2b^r		23218*c*
		4302·8			3b^r		23234*c*
		4299·2			2b^r		23253*c*
		4295·5			2b^r		23273*c*
‡4290		4292·0			1b^r		23292*c*
‡4285		4288·3			1b^r		23312*c*
‡4279		4281·8			1b^r		23348*c*
‡4274		4277·8			1b^r		23369*c*
‡4268		4273·9			1b^r		23391*c*
‡4261		4268·9	4272	§§4266·0	0 5b^r	10n	23434*e*
‡4256		4263·1			0·5b^r		23450*c*
‡4249		4256·0			0·5b^r		23489*c*
‡4243		4248·1			0·3b^r		23533*c*
‡4239		4241·0			0·3b^r		23572*c*
‡4232		4234·0			0·2b^r		23611*c*
			4196			4s	23825*d*
			4192			4s	23848*d*
			4141			2s	24142*d*
			4130			2s	24206*d*
			4089			2s	24455*d*

CARBON—*continued.*

II. Line Spectrum		Intensity and Character	Osc. Freq.	II. Line Spectrum		Intensity and Character	Osc. Freq.
Liveing and Dewar *d*	Hartley and Adeney *e*	II.		Liveing and Dewar *d*	Hartley and Adeney *e*	II.	
3919·3	‡‡3919·5	8sd	25506*de*	2968·0	2967·3	3sd	33687*de*
	3881·9	3sd	25753*e*	2837·2	2836·7	8sd	35238*de*
3876·5	3875·7	5sd	25792*de*	2836 3	2835·9	8sd	35249*de*
	3870·7	5sd	25827*e*	2746·5	2746·6	6nd	36397*de*
	3589·9	5sd	25847*e*	2733·2		1n	36576*d*
	3584·8	5sd	25887*e*	2740·7	2640·0	4sd	37863*de*
	3583·3	5sd	25899*e*	2511·9	2511·6	7sd	39801*de*
	3167·7	4sd	31565*e*	2509·0	2508·7	7sd	39847*de*
	3166·0	4sd	31576*e*	¶2478·3	2478·3	6sd	40337*de*
2995·0	2993·1	4b°d	33389*de*	2296·5	2297·7	7nd	43520*de*

* Observed also by Morren. † Observed also by Salet. ‡ Observed also by Plücker and Hittorf.
‖ Observed in the Hydrocarbon Flame by Lecoq de Boisbaudran, who, however, gives the yellowish-green band as 5629.
¶ Observed in the Arc by Liveing and Dewar. ** Double. †† Triple.
‡‡ 3905·0 Lockyer. §§ 4266·3 Hartley and Adeney.

APPENDIX TO CARBON

BAND SPECTRUM.

The following detailed and accurate measurements of the separate lines constituting the brighter bands of this spectrum have been made by Fievez, 'Mém. de l'Acad. roy. de Belgique,' xlvii. 1885. The source of light was the incandescent vapour existing between the carbon poles of a powerful electric light.

Greenish-yellow Band			Greenish-yellow Band		
Wave Length	Intensity	Osc. Freq.	Wave Length	Intensity	Osc. Freq.
5633·8	10	17745	5524·1	5	17775
5633·3	10	17746	5623·4	10	17777
5632·9	10	17747	5622·7	5	17780
5632·4	10	17749	5622·1	10	17782
5631·9	10	17751	5621·2	5	17784
5631·2	10	17753	5620·7	3	17786
5630·6	10	17755	5620·4	10	17787
5629·9	10	17757	5619·5	5	17790
5629·5	4	17758	5618·9	3	17792
5629·1	10	17759	5618·6	10	17793
5628·6	3	17761	5618·3	3	17794
5628·3	10	17762	5617·8	6	17795
5627·9	3	17763	5617·2	4	17797
5627·5	10	17765	5616·8	10	17798
5627·1	3	17766	5616·2	3	17800
5626·6	10	17767	5615·7	5	17802
5626·1	4	17769	5614·6	10	17805
5625·7	10	17770	5613·7	5	17808
5625·2	5	17772	5612·8	10	17810
5624·8	10	17773	5612·6	5	17812

CARBON—*continued.*

Greenish-yellow Band			Greenish-yellow Band		
Wave Length	Intensity	Osc. Freq.	Wave Length	Intensity	Osc. Freq.
5612·3	5	17813	5587·0	6	17894
5611·6	5	17815	5586·3	10	17896
5611·0	2	17816	5586·0	5	17897
5610·8	10	17817	5585·6	5	17898
5610·6	5	17818	5585·1	3	17900
5610·4	5	17819	5584·8	3	17901
5609·7	5	17821	5584·1	2	17903
5609·3	2	17822	5583·8	10	17904
5609·0	10	17823	5583·3	7	17905
5608·7	5	17824	5583·0	5	17906
5608·5	5	17825	5582·6	5	17908
5607·7	2	17827	5582·1	5	17909
5607·4	10	17828	5581·6	5	17911
5607·1	5	17829	5581·0	10	17913
5606·9	5	17830	5580·6	2	17914
5606·0	4	17833	5580·3	5	17915
5605·2	2	17835	5580·1	3	17916
5605·0	10	17836	5579·5	5	17918
5604·6	5	17837	5579·1	3	17919
5604·4	5	17838	5578·7	5	17920
5603·6	2	17840	5578·1	3	17922
5603·4	5	17841	5577·7	10	17923
5602·6	3	17843	5577·4	10	17924
5602·4	10	17844	5577·1	10	17925
5602·1	5	17845	5576·7	3	17927
5601·9	5	17846	5576·0	10	17929
5601·0	3	17849	5575·3	3	17931
5600·7	5	17850	5574·7	10	17933
5599·9	3	17852	5574·2	5	17935
5599·7	10	17853	5573·6	5	17937
5599·4	5	17854	5573·1	5	17938
5599·1	5	17855	5572·5	5	17940
5598·4	3	17857	5572·1	10	17941
5598·1	5	17858	5571·7	10	17943
5597·3	4	17860	5571·3	10	17944
5596·9	10	17862	5570·7	5	17946
5596·6	5	17862	5570·0	10	17948
5596·4	5	17863	5569·5	5	17950
5595·7	3	17865	5569·0	10	17952
5595·41	5	17865	5568·4	10	17953
5594·5	3	17869	5567·9	5	17955
5594·2	10	17870	5567·2	10	17957
5593·9	5	17871	5566·7	5	17959
5593·7	5	17872	5566·1	10	17961
5593·0	3	17874	5565·6	10	17962
5592·7	5	17875	5565·0	4	17964
5591·4	10	17879	5564·3	3	17967
5591·2	5	17880	5563·9	10	17968
5590·9	5	17881	5563·2	10	17970
5590·1	3	17883	5562·8	10	17971
5589·8	5	17884	5562·4	10	17973
5588·6	10	17888	5561·9	5	17974
5588·3	5	17889	5561·3	5	17976
5587·9	5	17892	5560·8	5	17978
5587·3	5	17893	5560·3	10	17979

CARBON—*continued.*

Greenish-yellow Band			Green Band		
Wave Length	Intensity	Osc. Freq.	Wave Length	Intensity	Osc. Freq.
5559·4	10	17982	5151·1	10	19408
5558·9	10	17984	5150·7	5	19409
5558·4	5	17986	5150·5	5	19410
5558·0	5	17987	5150·2	5	19411
5557·5	5	17989	5149·9	10	19412
5557·0	10	17990	5149·3	5	19414
5556·6	5	17991	5149·0	5	19416
5556·2	5	17993	5148·7	5	19417
5555·7	5	17994	5148·3	10	19418
5555·2	10	17996	5147·7	5	19420
5554·9	10	17997	5147·3	5	19422
5554·6	10	17998	5146·9	5	19424
5554·2	5	17999	5146·5	10	19426
5553·8	5	18000	5145·6	5	19428
5553·4	5	18002	5145·1	4	19430
5553·0	10	18003	5144·7	5	19432
5552·6	5	18004	5144·3	10	19433
5552·2	5	18006	5143·6	5	19436
5551·8	10	18007	5143·1	5	19438
5551·5	10	18008	5142·8	5	19439
5551·0	3	18009	5142·3	10	19441
5550·3	3	18012	5141·6	5	19443
			5141·2	5	19445
Green Band			5140·8	5	19447
5164·9	10	19356	5140·3	10	19448
5164·4	10	19358	5139·8	2	19450
5164·0	10	19359	5139·4	5	19452
5163·6	10	19361	5139·1	5	19453
5163·1	10	19363	5138·8	5	19454
5162·7	10	19364	5138·4	10	19456
5162·3	10	19366	5137·9	2	19458
5161·8	10	19367	5137·4	5	19459
5161·3	10	19369	5137·2	5	19460
5160·9	10	19371	5136·8	5	19462
5160·4	10	19373	5136·3	10	19464
5159·6	10	19376	5136·0	2	19465
5159·0	10	19378	5135·6	5	19466
5158·5	5	19380	5135·3	5	19467
5158·0	10	19382	5135·0	5	19469
5157·5	5	19384	5134·7	10	19470
5157·0	10	19385	5134·2	2	19472
5156·6	5	19387	5133·8	5	19473
5156·2	10	19388	5133·5	5	19474
5155·7	6	19390	5133·1	5	19476
5155·2	10	19392	5132·8	10	19477
5154·6	5	19395	5132·4	2	19478
5154·3	6	19396	5132·0	5	19480
5153·9	10	19397	5131·7	5	19481
5153·3	6	19399	5131·3	5	19483
5152·9	5	19400	5131·0	10	19484
5152·5	10	19402	5130·6	3	19485
5152·0	6	19404	5130·2	5	19487
5151·8	6	19405	5130·0	5	19488
5151·4	6	19407	5129·6	5	19489

CARBON—*continued.*

Green Band		
Wave Length	Intensity	Osc. Freq.
5129·2	10	19490
5128·7	10	19492
5128·5	10	19493
5128·1	10	19495
5127·9	10	
5127·5	5	19497
5127·1	10	19498
5126·7	10	19500
5126·0	5	19503
5125·3	10	19505
5125·0	5	19507
5124·2	10	19509
5124·0	10	19510
5123·0	5	19514
5122·6	10	19516
5122·0	5	19518
5121·0	10	19522
5119·3	10	19528
5118·7	5	19530
5118·1	6	19533
5117·6	10	19535
5117·0	5	19537
5116·3	10	19540
5115·6	5	19542
5115·0	10	19545
5114·3	5	19547
5113·6	10	19550
5112·4	10	19555
5111·1	10	19560
5109·6	10	19565
5109·2	5	19567
5108·5	10	19569
5108·1	4	19571
5107·6	5	19573
5107·1	10	19575
5106·8	5	19576
5106·4	5	19578
5106·0	10	19579
5105·5	5	19581
5105·0	5	19583
5104·6	10	19584
5104·1	5	19587
5103·7	5	19588
5103·1	10	19590
5102·6	6	19592
5101·9	6	19595
5101·4	10	19597
5100·9	5	19599
5100·2	5	19601
5099·6	10	19604
5097·9	10	19610
5096·4	10	19616
5095·0	10	19621
5094·5	5	19623
5094·1	5	19625

Green Band		
Wave Length	Intensity	Osc. Freq.
5093·7	10	19626
5092·1	10	19633
5090·6	10	19638
5090·1	5	19640
5089·7	5	19642
5089·2	10	19644
5088·9	5	19645
5088·4	5	19647
5088·0	10	19648
5086·9	10	19653
5086·7	10	19654
5086·2	5	19655
5085·8	5	19657
5085·2	10	19659
5084·8	5	19661
5084·3	5	19663
5083·9	10	19664
5082·6	10	19669
5082·3	10	19670
5080·9	10	19676

Blue Band		
4735·4	10	21111
4734·9	10	21113
4734·5	10	21115
4734·1	10	21117
4733·8	10	21118
4733·4	10	21120
4732·9	10	21122
4732·4	10	21125
4731·9	10	21127
4731·4	10	21129
4731·0	10	21131
4730·6	10	21133
4730·2	10	21134
4729·8	10	21136
4729·6	10	21137
4728·8	10	21141
4728·0	10	21144
4727·2	10	21148
4726·2	10	21152
4725·3	10	21156
4724·2	10	21162
4723·2	10	21166
4722·1	10	21171
4721·1	10	21175
4720·1	10	21180
4719·1	10	21184
4718·2	10	21188
4717·3	10	21192
4716·4	10	21196
4715·6	10	21200
4714·7	10	21204
4713·8	10	21208
4713·5	10	21209

CARBON—*continued.*

Blue Band			Blue Band		
Wave Length	Intensity	Osc. Freq.	Wave Length	Intensity	Osc. Freq.
4713·0	5	21212	4678·9	10	21366
4712·2	10	21215	4678·6	10	21368
4712·0	5	21216	4677·9	5	21371
4711·0	5	21221	4677·3	5	21373
4710·7	10	21222	4676·7	10	21376
4710·3	5	21224	4676·2	5	21378
4709·1	10	21229	4675·4	5	21382
4708·8	5	21231	4674·9	10	21384
4708·0	5	21234	4674·1	10	21388
4707·6	10	21236	4673·2	10	21392
4707·0	5	21239	4672·9	10	21394
4706·3	10	21242	4672·2	10	21397
4706·0	10	21243	4671·9	10	21398
4705·0	5	21248	4670·9	10	21403
4704·1	10	21252	4670·5	10	21405
4703·9	10	21253	4670·1	10	21406
4702·0	10	21261	4669·5	10	21409
4701·1	5	21265	4668·9	10	21411
4700·2	10	21269	4668·3	10	21415
4699·4	5	21273	4667·7	10	21417
4698·8	10	21276	4666·8	10	21422
4698·5	10	21277	4666·0	10	21425
4697·3	10	21282	4665·6	10	21427
4696·5	10	21286	4664·7	10	21431
4696·2	10	21287	4663·5	10	21437
4695·5	5	21291	4663·2	10	21438
4694·8	10	21294	4662·1	10	21443
4694·4	10	21296	4661·8	5	21445
4693·2	10	21301	4660·8	5	21449
4692·1	10	21306	4660·4	10	21451
4691·9	10	21307	4659·9	5	21454
4690·8	5	21312	4659·6	5	21455
4690·2	10	21315	4659·0	10	21457
4689·9	10	21316	4658·0	10	21462
4688·9	10	21321	4657·0	10	21467
4687·1	10	21329	4656·2	10	21470
4686·8	10	21330	4655·9	10	21472
4685·3	10	21337	4655·3	5	21474
4684·1	10	21342	4654·3	5	21479
4683·8	10	21344	4653·7	10	21482
4682·3	10	21351	4652·8	10	21486
4681·6	10	21354	4652·0	5	21490
4681·1	10	21356	4651·4	10	21492
4680·1	10	21361	4651·1	10	21493

Cerium.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Thalén, 'Nova Acta Soc. Upsal' (III.) vol. vi.
Bunsen, 'Pogg. Ann.' clv. 366.
Lockyer, 'Proc. Roy. Soc.' xxvii. 280. 'Phil. Trans.' 1881, pt. iii.

I. Spark Spectrum		Intensity and Character	Osc. Freq.	I. Spark Spectrum		Intensity and Character	Osc. Freq.
Kirchhoff *a*	Thalén *b*			Kirchhoff *a*	Thalén *b*		
	5654·1	2sd	17681*b*	4561·8	4562·1	10sc	21914*ab*
5636·3		1sc	17737*a*	4560·6	4560·6	8nc	21920*ab*
	5600·2	2sd	17851*b*	4539·1	4539·6	8nc	22023*ab*
5563·5	5564·2	2sd	17968*ab*	4527·4	4527·6	8nc	22081*ab*
5555·1			17996*a*	4526·5	4526·6	10nd	22085*ab*
	5511·2	8sc	18140*b*	4523·1	4523·1	8sc	22102*ab*
5471·8	5472·2	6sd	18269*ab*		4486·1	2sd	22285*b*
5466·8	5467·2	4sd	18286*ab*		4482·6	2sd	22302*b*
5463·5	5463·2	2sd	18299*ab*		4479·1	2sd	22319*b*
5409·9	5408·7	8sc	18481*ab*	4471·2	4471·6	8nc	22353*ab*
5392·4	5392·7	8sc	18539*ab*		4467·1	2sc	22379*b*
5352·6	5352·2	10sc	18678*ab*		4462·5	2sc	22402*b*
5330·0	5330·2	6sd	18756*ab*	4460·6	4459·6	10nc	22413*ab*
5273·4	5273·2	10sc	18958*ab*		4448·6	6nc	22477*b*
5230·6		1n	19113*a*		4443·6	6sc	22498*b*
5229·5		3s	19117*a*		4428·1	8sc	22576*b*
5191·0	5190·7	4sd	19259*ab*		4419·1	8sc	22622*b*
5186·4	5187·2	6sd	19274*ab*		4410·1	2sd	22669*b*
	5161·2	2sd	19370*b*		4398·1	2sd	22730*b*
5146·6		1sc	19425*a*	4390·3	4391·5	8sc	22768*ab*
5116·1		1sc	19546*a*	4385·2	4385·5	8sc	22797*ab*
5078·9	5079·1	6sc	19683*ab*	4381·9	4382·0	8sc	22814*ab*
5075·3	5072·2	4sd	19703*ab*		4365·0	2sd	22903*b*
4970·7	4970·2	2sd	20113*ab*		4296·0	10nc	23270*b*
4882·1		1s	20477*a*		4289·0	10nc	23308*b*
4735·3		1s	21112*a*		4185·5	6nd	23885*b*
4712·8	4713·6	8nc	21211*ab*		4165·0	4nd	24003*b*
4627·5	4628·2	10sc	21602*ab*		4149·0	4nd	24095*b*
	4624·2	2sd	21619*b*		4136·5	4sd	24168*b*
	4605·7	2sd	21706*b*		4132·5	4sd	24191*b*
4594·0	4594·1	6sc	21760*ab*	Lockyer	4127·0	2sd	24224*b*
	4582·6	2sd	21815*b*		4124·0	2sd	24241*b*
	4578·6	2sd	21834*b*	4012·0			24312*a*
4572·5	4572·6	10sc	21863*ab*	3928·7			25446*a*
	4564·6	2sd	21901*b*				

Lockyer has observed the following lines in the Arc Spectrum of Cerium between th
wave lengths 4000 and 3900 :—3998·7, 3997·3, 3993·2, 3992·4, 3991·7, 3991·0, 3984·0, 3980·(
3977·8, 3974·3, 3971·5, 3971·2, 3966·6, 3962·1, 3959·8, 3955·0, 3951·6, 3941·8, 3941·4, 3939·2
3937·2, 3930·5, 3930·2, 3923·9, 3922·2, 3919·1, 3917·5, 3911·9, 3911·6, 3910·4, 3907·8, 3901·3

Chlorine.

Van der Willigen, 'Pogg. Ann.' cvi. p. 624, 1859.
Plücker, 'Pogg. Ann.' cvii. p. 528, 1859.
Plücker and Hittorf, 'Phil. Trans.' clv. p. 24, 1865.
Ditte, 'Compt. Rend.' lxxiii. 622.
Ångström, 'Compt. Rend.' lxxiii. 369.
Thalén, 'Kongl. Svenska Vetenskaps-Akademiens Handlingar,' xii. No. 4, p. 8.
Hasselberg, 'Bull. Acad. St. Petersb.' xxviii. 405.
Salet, 'Ann. Chim. Phys.' (4) xxviii. p. 24, 1873.
Ciamician, 'Wien. Ber.' lxxviii. (II.) p. 872, 1878.

Spark Spectrum				Intensity and Character	Osc. Freq.
Salet *a*	Plücker *b*	Thalén *c*	Hasselberg *d*		
	6758·8			2	14791*b*
	6711·1			2	14896*b*
	6681·4			2	14962*b*
6670	6657·1			2	15017*b*
6110	6093·4			8	16406*b*
	5937·6			1	16837*b*
	5930·5			1	16857*b*
	5785·4			2	17430*b*
	5714·0			2	17496*b*
	5681·1			2	17597*b*
	5669·0			2	17634*b*
	5635·1			2	17741*b*
	5596·2	5593·5		2	17872*c*
	5572 4			2	17940*b*
	5536·4			2	18057*b*
	5529·3	5527·7		2	18085*c*
5460	(5456·1)	5455·5	5456·7	7	18323*cd*
5445	(5443·5)	5443·5	5443·6	8	18365*cd*
5420	(5423·5)	5423·0	5424·0	9	18433*cd*
5390	(5391·9)	5391·5	5392·4	9	18541*cd*
	5362·1	5355·0		2	18669*c*
	5332·7	5332·0		2	18749*c*
		5312·5		1	18818*c*
	5284·3	5285·0	5284·7	3	18915*cd*
5215	(5219·9)	5220·0	5219·8	8	19152*cd*
	(5216·3)	5216·5	5216·2	10	19165*cd*
	5194·6	5205·5		4	19205*c*
	5190·1	5188·0	5188·8	2	19268*cd*
	5177·1	5174·0		2	19322*c*
	5174·7	5172·0	5172·2	2	19329*cd*
	5168·6	5160·0	5160·8	2	19373*cd*
	5162·8	5142·0		2	19442*c*
	5124·2	5112·0	5112·8	2	19555*cd*
	5106 2	5102·7	5102·4	6	19592*cd*
5097	5101·2	5098·2	5098·2	6	19609*cd*
5075	5082·2	5077·0	5077·6	8	19690*cd*
	5071 5			1	19712*b*
	5049·2			1	19799*b*
		5030·5		1	19873*c*
		5020·5		1	19912*c*
	5009·2			2	19957*b*
	5005·2			2	19973*b*
5000	4998·7	4994·0	4997·7	5	20012*cd*
4975	4973·1	4967·5	4972·4	3	20115*cd*
	4947·8	4941·0	4945·3	2	20225*cd*

CHLORINE—*continued.*

Spark Spectrum				Intensity and Character	Osc. Freq.
Salet *a*	Plücker *b*	Thalén *c*	Hasselberg *d*		
	4941·6	4935·0	4937·9	2	20251*cd*
	4932·7			2	20267*b*
4920	(4924·4)	4923·5	4925·3	5	20301*cd*
4903	(4917·8)	4916·5	4917·2	6	20331*cd*
4895	(4900·0)	4903·2	4904·4	7	20386*cd*
		4895 5	4896·9	7	20418*cd*
4820	(4818·7)	4817·7	4819·8	10	20746*cd*
4810	(4809·7)	4809·7	4809·7	10	20785*cd*
4795	(4793·4)	4793·0	4793·9	10	20856*cd*
	4782·3			2	20904*b*
4785	4778·5	4779·5	4780·8	5	20914*cd*
	4773·6	4773·5		2	20942*bc*
4770	4768·6	4768·0	4769·0	4	20965*cd*
	4767·3			6	20970*b*
	4753·1			2	21033*b*
4740	4736·6	4739·0	4739·7	5n	21094*cd*
	4700·0	4704·5		3	21250*c*
		4698·0		1	21279*c*
		4660·0		2	21453*c*
		4648·0		4	21508*c*
	4641·2	4640·0		4	21545*c*
		4638·0		4	21554*c*
	4627·3			2	21604*b*
	4606·2	4608·0		1	21695*c*
	4595·1	4596·0		2	21751*c*
4575	4589·8	4590·5		2b	21777*c*
	4581·8			1	21819*b*
	4571·4			1	21868*b*
	4565·7			1	21896*b*
	4545·2			1	21994*b*
	4536·1			1	22039*b*
	4525·1	4527·0		2	22086*b*
	4504·8			1	22192*b*
	4496·5			1	22232*b*
	4489 6			1	22267*b*
4352	4346·6			8n	23000*b*
	4338·8			2	23042*b*
4315	4313·1			4n	23178*b*
	4295·0			2	23276*b*
	4282·1			1	23346*b*
	4278·3			1	23367*b*
4260	4259·3			3b	23471*b*
4130				2n	24206*b*

Ångström gives lines of Chlorine at 5460, 5399, 5213, 4940, 4895, 4820, 4808, 4793, 4647, 4630.

Chromium.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil. Trans.' 1864, p. 139.
Thalén, 'Nova Acta Soc. Upsal' (III.) vi.
Ångström, 'Recherches sur le Spectre solaire,' 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Lockyer, 'Phil. Trans.' 1881, pt. iii.
Liveing and Dewar, 'Proc. Roy. Soc.' No. 214, 1881.

I. Spark Spectrum			II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Liveing and Dewar *e*	I.	II.	
6659					1		15013*a*
6499					1		15382*a*
6461					1		15473*a*
6436					1		15533*a*
6157					1		16237*a*
6116					2		16346*a*
6100					1		16389*a*
5790					1		17269*a*
5784					1		17284*a*
5780					1		17293*a*
5638					1		17731*a*
5605					1		17836*a*
5411	*5409·1	5408·9	5409·1		8sc		18482*bc*
5346	5342·6				2sd		18712*b*
5342	*5341·1				2sd		18717*b*
5321	*5318·1				2sd		18798*b*
	5313·1				2sd		18816*b*
5295	*5296·7				2sd		18874*b*
	5296·2				2sd		18875*b*
5274	*5274·4				4sd		18954*b*
5265					1sc		18988*b*
5264	*5263·5				4sd		18993*b*
5252	5254·1				4sd		19027*b*
5246	5246·5				4sd		19055*b*
5236					1		19093*a*
5224					1		19137*a*
5207	*5207·8	5207·6	‡5207·8	(5207·8)	10sc	r	19197*bc*
5203	*5206·4	5205·4	5206·4	(5206·4)	10sc	r	19202*b*
5202	*5203·9	5203·9	5203·9	(5203·9)	10sc	r	19211*bc*
5152					2		19404*a*
5104					1		19587*a*
4921	4924·1				4sd		20303*b*
4886					1		20460*a*
4876					1		20503*a*
4871					1		20524*a*
4862					1		20562*a*
4829					1		20702*a*
4824					2		20724*a*
4788					1		20879*a*
4756					1		21020*a*
4753					1		21033*a*
4738					1		21100*a*
4730					1		21135*a*
4718					1		21189*a*
4652	4654·0		4654·0		4sd		21485*b*
4648				4650·5	1		21497*e*

Salet *a*	Plücker *b*		Intensity and Character		Osc. Freq.
			I.	II.	
	4941·6				
	4932·7				
4920	(4924·4		4sd		21515*b*
4903	(4917·8		1		21587*a*
4895	(4900·0		1		21662*a*
			1		21732*a*
4820	(4818·7		1		21794*a*
4810	(4809·7		1		21928*a*
4795	(4793·4		1		21942*a*
	4782·3		1		22015*a*
4785	4778·5		1		22044*a*
	4773·6		1		22074*a*
4770	4768·6		1		22097*a*
	4767·3		4sd		22239*b*
	4753·1		4sd		22814*b*
4740	4736·6		4sd		22886*b*
	4700·0		4sd		22934*b*
			8sc		22972*b*
			8sc		23011*b*
			8sc		23044*b*
	4641·2		8sd		23046*b*
			6sd		23062*b*
	4627·3	[illegible]	10sc	r	23306*b*
	4606·2	[illegible]	10sc	r	23387*b*
	4595·1	[illegible]	10sc	r	23501*b*
4575	4589·8				23651*a*
	4581·8				23712*a*
	4571·4				25042*c*
	4565·7				25049*c*
	4545·2				25060*c*
	4536·1				25095*c*
	4525·1				25098*c*
	4504·8				25146*c*
	4496·5				25189*c*
	4489·6				25195*c*
4352	4346·6				25228*c*
	4338·8				25370*c*
4315	4313·1				25452*c*
	4295·0				25502*c*
	4282·1				25513*c*
	4278·3				25531*c*
4260	4259·3				25579*c*
4130				r	27723*e*
				r	27823*e*
				r	27940*e*
				r	29011*e*
				r	31075*e*
				r	35705*e*
				r	35741*e*
				r	35779*e*
				r	35965*e*

Ångström gives lines 4617, 4630.

[illegible]nium Chloride solution.
[illegible]nc here is double.

Cobalt.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil. Trans.' 1864, p. 139.
Thalén, 'Nova Acta Soc. Upsal' (III.) vi.
Ångström, 'Recherches sur le Spectre Solaire,' 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Lockyer, 'Phil. Trans.' 1881, pt. III.
Cornu, 'Spectre Normal du Soleil,' Paris, 1881.

I. Spark Spectrum.				II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Schuster *d*	Ångström and Thalén *e*	I.	II.	
‡*6453					1n		15492*a*
6349					1s		15746*a*
6298					1s		15873*a*
6275					1s		15932*a*
6247					1s		16003*a*
	†6142·7(2)	6143·0			6sc		16277*bc*
	†6121·4(2)	6120·9			6sc		16332*bc*
‡6116					1n		16346*a*
‡6084					1s		16432*a*
‡6047					1s		16532*a*
6002	‡6003·7	6002·6			8nc		16653*bc*
6000					1s		16662*a*
5989					1s		16692*a*
5983					1s		16709*a*
5915					2s		16901*a*
5843					2s		17110*a*
5838					1s		17124*a*
5644					1s		17713*a*
5634					1s		17744*a*
5590					1s		17884*a*
5481	†5482·5(4)	5482·5	(5482·5)(5)		4sd		18235*bc*
	†*5452·1(2)	5452·4	5452·1(3)		6sc		18336*bcd*
5443	†5443·1(2)	5443·0	(5443·1)(4)		6sc		18366*bc*
5379							18585*a*
5368	†5368·1(2)	5368·5	(5368·1)(4)	5368·1	6sc		18622*bc*
5360	†5362·7(2)	5362·2	(5362·7)(3)	5362·7	2sd		18643*bc*
5356	†5359·6(2)	5358·6	(5359 6)(2)	5359·6	2sd		18654*bc*
5351	†5352·5(4)	5352·5	(5352·5)(5)	5352·5	6sc		18677*bc*
5350	†5351·3(4)	5351·2	(5351·3)(5)	5351·3	6sc		18681*bc*
5344	†5342·6(4)	5342·3	(5342·6)(6)	5342·6	2sd		18713*bc*
5338	†5342·1(4)	5341·6	(5342·1)(6)	5342·1	2sd		18715*bc*
5329					1s		18760*a*
5320					1s		18791*a*
5317					1s		18802*a*
5313					1s		18816*a*
5309					1s		18830*a*
5290					1s		18898*a*
5285					1s		18916*a*
5281 5279	§†5279·6(4)	5279·8	(5279·6)(5)	5279·6	6sc		18935*bc*
5274			5275·2		1s		18951*d*
5267	†5267·2(4)	5267·7	(5267·2)(3)	5267·2	2sd		18979*bc*
5265	§†5265·9(4)	5265·6	(5265·9)(5)	5265·9	6sc		18985*bc*
5254			(5254)(1)		1s		19027*a*
5252			(5252)(1)		1s		19035*a*
5249			(5249)(1)		1s		19045*a*

COBALT—*continued.*

I. Spark Spectrum				II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Schuster *d*	Ångström and Thalén *e*	I.	II.	
5247			(5247)(1)		1s		19053*a*
*5234	†5234·6(4)•	5234·5	(5234·4)(3)	5234·3	2sd		19099*bc*
5228	†5230·2(2)	5230·2	(5230·2)(3)	5230·2	2sd		19114*bc*
*5213	†5212·2(3)		(5212·2)(4)		2sd		19180*b*
5200							19225*a*
*5190					1s		19262*a*
*5184					1s		19285*a*
*5156			5158·6(2)		1s		19379*d*
*5147			5155·1(3) / 5134·3(3)		1s		19393*d* / 19471*d*
*5128			5127·1(5)				19498*d*
5105			5110·2(5)		1n		19563*d*
5074					1n		19702*a*
5061					1n		19753*a*
5054					1s		19780*a*
5028					1s		19883*a*
4967					1s		20127*a*
*4870	†4867·1(4)	4867·6	(4867·1)(5)	4867·1	10sc		20539*bc*
*4841	†4839·1(4)	4839·9	(4839·1)(5)	4839·1	10sc		20657*bc*
*4814	†4813·6(2)	4813·4	(4813·6)(5)	4813·6	10sc		20769*bc*
*4793	†4791·8(4)	4791·7	(4791·8)(5)	4791·8	10sc		20863*bc*
	*†4778·8(4)	4778·9	4779·1(5)	4778·8	10sc		20920*bc*
*4751	†4748·6	4749·2	(4748·6)(3)	4748·6	4sd		21051*bc*
4737					1s		21104*a*
4720					1s		21180*a*
			4716·8		1s		21195*d*
			4694·1		1s		21297*d*
*4683			4683·1		1s		21347*d*
			4664·3		1s		21433*d*
*4581	‖†4580·8(2)	4580·8			4sd		21824*bc*
*4565					5n		21899*a*
*4549					1s		21976*a*
*4530	†4530·6(4)	4530·4		4530·6	4sd		22066*bc*
*4120					2n		24265*a*
4119					1s		24270*a*
4113					1s		24306*a*
*4097				Lockyer	1n		24401*a*
				3997·3			25009
				3994·6			25026
				3991·0			25049
				3989·7			25057
				3978·8			25126
				3977·8			25126
				3973·8			25157
				3972·4			25166
				3971·5			25168
				3960·3			25243
				3957·0			25264
				3951·9			25297
				3951·1			25302
				3946·0			25334
				3940·8			25368
				3939·7			25375
				3937·7			25388

COBALT—*continued.*

Spark Spectrum	Arc Spectrum	Intensity and Character	Osc. Freq.
Cornu	Lockyer		
	3934·9		25406
	3928·3		25449
	3921·8		25491
	3919·8		25504
	3916·5		25525
	3909·2		25569
	3905·8		25595
3501·8			28548
3462·0			28876
3453·2			28950
3443·0			29036
3403·8			29370

* Observed in the Spark Spectrum of Cobalt Chloride solution by Lecoq de Boisbaudran, who gives also lines at 5524, 4663, 4629, 4599, 4471, 4372, 3997.
† Observed also by Lockyer. The 'indices' attached to these numbers, and to those by Schuster, represent the comparative 'lengths' of the lines.
‡ Not identified (Lockyer). § Double. ‖ See Calcium and Iron.

COPPER.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Thalén, 'Nova Acta Soc. Upsal' (III.) vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Liveing and Dewar, 'Proc. Roy. Soc.' xxix. 402, 1879; 'Phil. Trans.' clxxiv. p. 205, 1883.
Hartley and Adeney, 'Phil. Trans.' clxxv. p. 63, 1883.

I. Spark Spectrum		II. Arc Spectrum	Intensity and Character	Osc. Freq.	I. Spark Spectrum		II. Arc Spectrum	Intensity and Character	Osc. Freq.
Thalén *a*	Kirchhoff *b*	Liveing and Dewar *c*	I.		Thalén *a*	Hartley and Adeney *b*	Liveing and Dewar *c*	I.	
6380·0			8sc	15669*a*	4275·0	4274·2		4sd	23387*ab*
6218·5			2sd	16077*a*		3598·9		3sd	27778*b*
†*5781·4	5782·0		8sc	17292*a*		3596·6		3sd	27796*b*
*5700·5			10sc	17537*a*		3523·6		2sd	28371*b*
*5292·1	5291·7		8sc	18890*a*		3510·4		2sd	28478*b*
†*5217·3	5217·7		10sc	19161*a*		3483·2		2sd	28700*b*
*5152·8	5152·7	(5152·8)	10scr	19401*a*		3478·8		2sd	28736*b*
†*5105·0	5104·9	(5105·0)	10scr	19583*a*		3471·6		2sd	28796*b*
5011·5			4sd	19948*a*		3455·8		2sd	28927*b*
4955·6			6nd	20173*a*		3450 1		2sd	28976*b*
4932·6			6nd	20267*a*		§3381·0		1sd	29568*b*
4911·6			6nd	20354*a*		‖3306·8		5sd	30232*b*
4703·1			6sd	21256*a*		‖3289·9		5sd	30387*b*
*4650·7	4650·3		6sd	21496*a*		3282·1		4sd	30459*b*

COPPER—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character	Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character	Osc. Freq.
Hartley and Adeney *a*	Liveing and Dewar *b*	I.		Hartley and Adeney *a*	Liveing and Dewar *b*	I.	
§‖3280·1		2sd	30478*a*	2522·7		1nd	39627*a*
‖3273·2		9sc	30542*a*	2522·1		1nd	39637*a*
3265·2		3sd	30617*a*	2518·3		1nd	39697*a*
3260·2		2sd	30664*a*	2517·5		1nd	39699*a*
‖3246·9		10sc	30789*a*	2513·2		1nd	39779*a*
?3243·9		2sd	30827*a*	2512·2		1nd	39793*a*
?3233·4		2sd	30918*a*	2508·7		3sd	39849*a*
3139·7		2sd	31850*a*	§2506·2		6sd	39888*a*
3134·2		2sd	31896*a*	2497·4		1sd	40029*a*
3123·7		3sd	32003*a*	2495·9		1sd	40053*a*
3115·7		2sd	32085*a*	2491·4		3sc	40125*a*
3107·4		3sd	32169*a*	2489·1		6sd	40162*a*
3097·8		2sd	32271*a*	§2485·6		6sd	40219*a*
3035·6		2sd	32933*a*	2481·8		3sd	40280*a*
3023·4		2sd	33066*a*	2478·2		2sd	40339*a*
2959·6		3sd	33778*a*	2475·1		1sd	40389*a*
2882·4		2sd	34682*a*	§2473·2		5sd	40420*a*
2877·4		3sd	34743*a*	2468·4		3sd	40499*a*
	2852·0		35052*a*	2465·2		1nd	40551*a*
2836·5		3sd	35243*a*	2461·5		1nd	40612*a*
2823·2		3sd	35409*a*	2458·2		1nd	40667*a*
	2802·4		35672*b*	2452·5		1nd	40761*a*
	2795·2		35764*b*	2446·7		1nd	40858*a*
	2779·4		35967*b*	2444·1		3sd	40901*a*
2769·1		7sd	36101*a*	2441·6		3sd	40943*a*
§** 2766·2		3sd	36139*a*	2439·8		1sd	40974*a*
2745·9		3sd	36417*a*	2435·7		1sd	41042*a*
2721·2		4sd	36738*a*	2430·3		1sd	41134*a*
2718·4		4sd	36776*a*	2428·2		1sd	41169*a*
2713·1		6sd	36847*a*	2425·1		3sd	41222*a*
2702·7		7sd	36989*a*	2422·0		1sd	41275*a*
2700·5		7sd	37019*a*	2412·2		3sd	41442*a*
2688·8		7sd	37180*a*	2404·8		3sd	41570*a*
2666·0		3sd	37498*a*	2403·3		6sd	41596*a*
2643·5		1sd	37826*a*	2400·1		6sd	41651*a*
2617·8		3sd	38188*a*	2393·0		1sd	41775*a*
2608·9		2sd	38333*a*	2392·2		1sd	41789*a*
2599·7		7sd	38454*a*	2385·2		1sd	41911*a*
2598·3		7sd	38475*a*	2376·7		3sd	42061*a*
2590·1		3sd	38597*a*	2371·6		2sd	42151*a*
2573·0		2nd	38853*a*	2370·1		9b^{r}	42178*a*
2572·0		2nd	38868*a*	2368·7		2sd	42203*a*
2570·9		2sd	38885*a*	**2365·8		1	42255*a*
2565·3		2nd	38970*a*	2357·2		5sd	42409*a*
2553·7		1nd	39147*a*	2355·0		2sd	42450*a*
2552·2		2nd	39170*a*	2348·8		2sd	42560*a*
2544·6		8sd	39287*a*	2346·2		2sd	42609*a*
2538·2		2nd	39386*a*	2336·6		3sd	42784*a*
2533·9		2nd	39452*a*	2303·8		1sd	43393*a*
2531·4		2nd	39491*a*	2300·5		1sd	43456*a*
2528·8		6sd	39529*a*	2297·5		1sd	43512*a*
2526·2		6sd	39573*a*				

COPPER—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character	Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character	Osc. Freq.
Hartley and Adeney *a*	Liveing and Dewar *b*	I.		Hartley and Adeney *a*	Liveing and Dewar *b*	I.	
2295·0		6sd	43548*a*	2214·1		2sd	45151*a*
2294·6	2294·1	3sd	43573*ab*	2211·3		6sd	45208*a*
2291·4		3sd	43626*a*	2210·8		3nd	45218*a*
2286·7		3sd	43718*a*		2209·7		45241*b*
2279·6		2sd	43854*a*	2208·8		2sd	45259*a*
2277·0	2276·0	6sd	43914*ab*	2200·3		3sd	45434*a*
2265·8		2sd	44121*a*	2199·8	2199·2	1nd	45450*ab*
2263·9	2261·6	3nd	44162*ab*	2196·5		3sd	45512*a*
2263·2		3nd	44172*a*	2192·0	2191·8	6sd	45608*ab*
2257·7		2sd	44279*a*	2191·2		3nd	45627*a*
2250·0		2sd	44431*a*	2189·6	2189·2	6sd	45660*ab*
2248·2		9sd	44466*a*	2188·5		3nd	45683*a*
2247·7		3nd	44476*a*	2181·0		1sd	45836*a*
	2246·6		44498*b*	2179·0	2178·8	5sd	45880*ab*
2244·0		9sd	44549*a*	2178·0		3nd	45899*a*
2243·5	2242·2	3nd	44573*ab*	2174·5		3sd	45973*a*
2233·0		3sd	44769*a*	2148·8	2148·9	3sd	46520*ab*
2232·2		3sd	44735*a*	2135·8	2135·7	3sd	46808*ab*
2231·2		5sd	44805*a*	2134·2		2nd	46841*a*
2230·0		5sd	44829*a*	2124·4		3sd	47057*a*
2229·1	2228·6	3sd	44843*ab*	2124·0		2nd	47065*a*
2228·1	2228·3	3sd	44865*ab*	2122·1		3sd	47108*a*
2227·0		1sd	44889*a*	2121·5		2nd	47121*a*
2226·0		1sd	44910*a*	2116·0		1sd	47243*a*
2219·3		6sd	45045*a*	2110·5		1sd	47366*a*
2218·5		3nd	45061*a*	2103·0		1sd	47535*a*
	2217·5		45080*b*				
2216·5		3nd	45102*a*				
2215·8		3sd	45116*a*				

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of solution of Copper Chloride.
† Observed (together with the Bands of the Oxide) by Lecoq de Boisbaudran in the Spectrum given by Copper Chloride in the flame of a Bunsen burner.
§ See Silver. ‖ See Tellurium. ** See Cadmium.

Didymium.

Gladstone, 'Chem. Soc. Journ.' x. 219.
Bunsen, 'Phil. Mag.' (4) xxviii. 246; xxxii. 177; l. 527, 'Pogg. Ann.' clv. 366.
Kirchhoff, 'Abh. Berl. Akad. 861.
Delafontaine, 'Pogg. Ann. cxxiv 635.
Thalén, 'Om Spektra tillhörande Yttrium Erbium Didym och Lantham,' Stockholm, 1874.
Lockyer, Phil. Trans. 1881 pt. iii.
Thalén, 'Öfversigt k. Vetensk Akad Förhandl.' xl. 1883.

Spark Spectrum		Intensity and Character	Osc. Freq.	Spark Spectrum		Intensity and Character	Osc. Freq.
Thalén *a*	Kirchhoff *b*			Thalén *a*	Kirchhoff *b*		
6740·0		4s	14832*a*	5593·5	5593·2	4s	17872*a*
6385 0		4s	15657*a*	5586·5	5587·1	2s	17892*a*
6346·0		1s	15753*a*	†5561·0		2s	17977*a*
6309·0		1s	15846*a*		5501·9 Di. La.		18171*b*
6301·0		1s	15866*a*		5500·6 Di. La.		18181*b*
6296·0		2s	15878*a*	‡5485·0	5484·1 Di. La.	6s	18226*a*
	6293·7 Di. La.		15884*b*	5478·5		1s	18248*a*
6256·0		1s	15980*a*		‡5452·6 Di. La.		18335*b*
6222·0		2s	16067*a*	5450·0		2s	18343*a*
6177·0		2s	16184*a*	5448·5		1n	18348*a*
6165·5		2s	16215*a*	5447·0		2s	18353*a*
6148·0		2s	16261*a*	5442·5		2n	18369*a*
6132·0		1s	16303*a*	5430·5	5431·2	3n	18409*a*
6120·0		1s	16335*a*	5422·0		1n	18438*a*
6113·0		2s	16354*a*	5416·0		1s	18458*a*
§6107·0		1s	16368*a*	5409 0		1s	18482*a*
6072·0		2s	16464*a*	5393·0		1n	18537*a*
6071·0		2s	16467*a*	5382·5		1n	18573*a*
6064·5		2s	16485*a*	5380·0		1n	18582*a*
6033·0		2s	16571*a*	5376·5		1n	18594*a*
6007·0		1s	16642*a*	*5371·0		6s	18613*a*
5995·5		1s	16674*a*	*5360·5	5359·9	6s	18649*a*
5993·0		1s	16681*a*	5356·5		4s	18663*a*
5988·0		1s	16695*a*	5322·0		4s	18784*a*
5867·0		1n	17040*a*	*5319·0	5319·1	8s	18795*a*
	5860·6 Di. La.		17058*b*	5311·5		2n	18821*a*
5857·0		1n	17069*a*	*‡5302·0	5301·3 Di. La.	2n	18855*a*
5845·0		1n	17103*a*	*5292·5		8s	18889*a*
5841·0		1n	17115*a*	5286·0		1s	18912*a*
5826·0		1n	17159*a*	5276·0		2n	18948*a*
5822·0		1n	17171*a*	*5272·5	5272·7	6s	18961*a*
5814·0		1n	17195*a*	*5268·5		2n	18975*a*
	5806·2 Di. La.	2sc	17218*b*	*5263·5		1n	18993*a*
5803·C	5805·1 Di. La.		17227*a*	5258·5	5258·4	4s	19011*a*
	‡5795·9 Di. La.	2s	17248*b*	*5254·5	5254·6	4s	19026*a*
	5790·0 Di. La.		17266*b*	5249·5		1s	19044*a*
	5786·1 Di. La.		17278*b*	*5248·5	5247·9	8s	19047*a*
	5767·7 Di. La.		17332*b*	5239·5		2s	19080*a*
5707·0		2s	17517*a*	*5233·5	5233·7	3s	19102*a*
5701·5		1s	17534*a*	5219·5		2s	19153*a*
5688·0		4s	17579*a*	5211·5		1n	19183*a*
5675·0		4s	17616*a*	5203·5		2s	19212*a*
5645·0		1s	17709*a*	5199·0		2s	19229*a*
5639·0		2s	17728*a*	5194·5		2s	19246*a*
5634·0		2s	17744*a*	*5191·5	5191·8 Di. La.	6s	19257*a*
5619·5		3s	17788*a*	*5190·5	5190·7 Di. La.	6s	19260*a*
5604·0		1s	17839*a*	5179·0		4s	19303*a*
5601·0		1n	17849*a*	5173·0		4s	19326*a*

DIDYMIUM—*continued.*

ırk Spectrum		Intensity and Character	Osc. Freq.	Spark Spectrum		Intensity and Character	Osc. Freq.
	Kirchhoff *b*			Thalén *a*	Kirchhoff *b*		
		1s	19357*a*	4718·5		2s	21187*a*
		2s	19478*a*	4715·0		1s	21203*a*
		1s	19482*a*	4709·0		1s	21230*a*
	5127·7	6s	19489*a*	4706·0		4s	21243*a*
	5122·2 Di. La.	4s	19513*a*	*‡4703·5		2n	21254*a*
	5113·8 Di. La.		19549*b*	4695·0		2b	21293*a*
		4s	19562*a*	‡4688·0		1b	21325*a*
		2s	19575*a*	4682·5		4s	21350*a*
		1s	19583*a*	4679·5		2s	21363*a*
		4s	19594*a*	4670·5		1b	21405*a*
		3s	19633*a*	4653·5		2s	21483*a*
		1s	19656*a*	4633·0		4s	21578*a*
		3s	19683*a*	4621·5		4s	21631*a*
		3s	19695*a*	4578·0		2s	21837*a*
		2n	19743*a*	4563·0		2s	21909*a*
		2n	19859*a*	4542·5		2s	22008*a*
	4999·8 Di. La.		19995*b*	*4541·5		2s	22013*a*
	4994·2 Di. La.		20017*b*	4516·0		2s	22137*a*
		3s	20038*a*	4509·0		2s	22171*a*
	4969·6 Di. La.		20115*b*	4501·5		2s	22208*a*
		2s	20153*a*	4496·0		2s	22236*a*
		4s	20163*a*	*4462·5		7s	22402*a*
		4s	20188*a*	4455·5		2s	22438*a*
		4s	20224*a*	4451·5		7s	22458*a*
	4933·9 Di. La.		20262*b*	4446·0		7s	22484*a*
		6s	20305*a*	‡4429·0		4n	22572*a*
	4921·5 Di. La.		20313*b*	4410·0		4s	22669*a*
	4920·7 Di. La.	4n	20319*a*	*4401·0		1s	22715*a*
		2s	20348*a*	4385·5		5s	22796*a*
		2s	20352*a*	4375·0		1s	22850*a*
		4s	20398*a*	4368·0		2s	22887*a*
	4899·1 Di. La.		20406*a*	4357·5		4n	22949*a*
		5s	20416*a*	4351·0		3n	22976*a*
		5s	20444*a*	4338·5		2s	23043*a*
		2s	20452*a*	4334·5		1s	23064*a*
		5s	20482*a*	4327·5		6s	23101*a*
		1s	20545*a*	*4325·0		4s	23114*a*
	4860·2 Di. La.		20569*b*	4303·0		6n	23223*a*
		4s	20577*a*	4285·0		2n	23330*a*
		4s	20724*a*	‡4282·0		2n	23346*a*
	4822·7 Di. La.		20729*b*	4277·5		n	23371*a*
		4s	20780*a*	4272·0		1n	23401*a*
		3s	20879*a*	4261·0		2s	23462*a*
		3s	20923*a*	4252·5		2n	23508*a*
		3s	20989*a*	4247·5		4n	23536*a*
	4746·5 Di. La.		21062*b*	4181·0		4n	23910*a*
	4741·0 Di. La.		21086*b*	4155·0		4s	24060*a*
	4740·0 Di. La.		21091*b*	4109·0		6s	24350*a*
		1s	21122*a*	4060·0		6s	24623*a*
		2s	21162*a*				

llowing lines between the wave lengths 3900 and 4000 have been observed by n the arc-spectrum of Didymium, 3994·0, 3985·5, 3978·8, 3975·8, 3972·4, 3964·5, 963·3, 3962·9, 3962·1, 3961·3, 3961·1, 3957·0, 3950·9, 3950·1, 3940·5, 3937·9, 3926·1, 918·1, 3917·0, 3910·4, 3907·8, 3905·3, 3901·3.

lines occur in Roscoe and Schuster's Terbium Spectrum. † Air? ‡ See Samarium.
§ Possibly due to Chlorine.

Erbium.

Bunsen and Bahr, 'Ann. Chem. Pharm.' cxxxvii. 1.
Huggins, 'Proc. Roy. Soc.' June 16, 1870.
Bunsen, 'Pogg. Ann.' clv. 366; 'Phil. Mag.' (4) l. 527.
Thalén, 'Om Spektra Yttrium Erbium Didym och Lanthan.' Stockholm, 1874.
Thalén, 'Öfversight k. Vetensk. Akad Förhandl.' xl.

Spark Spectrum	Intensity and Character	Osc. Freq.	Spark Spectrum	Intensity and Character	Osc. Freq.
Thalén			Thalén		
6076·0	4	16453	5041·5	2	19829
6044·0	2	16540	4951·0	8	20192
6014·5	2	16622	4899·0	8	20406
5881·0	4	16999	4871·5	6	20522
5871·0	4	17028	4830·0	4	20698
5854·0	2	17077	4819·0	6	20746
5850·0	1	17089	4794·5	4	20851
5826·0	8	17159	4762·0	2	20993
5762·0	6	17350	4758·0	2	21011
5756·0	4	17368	4750·0	1	21046
5738·0	2	17422	4678·0	2	21370
5732·0	2	17441	4674·0	8	21389
5626·0	1	17769	4605·5	8	21707
5485·0	4	18226	4565·5	1	21897
5456·0	2	18323	4562·5	2	21911
5343·5	6	18709	4552·5	2	21959
5256·0	8	19029	4500·5	6	22213
5217·0	6	19163	4474·5	1	22342
5188·0	6	19270	4458·5	2n	22423
5164·0	4	19363	4419·0		22623
5133·0	2	19476	4409·0		22674
5070·0	2	19718	4326·0		23109

Fluorine.

Séguin, 'C. R.' liv. p. 933, 1862.
Salet, 'Ann. Chim. Phys.' xxviii. p. 34, 1873.
Liveing, 'Proc. Cambridge Phil. Soc.' vol. iii. pt. iii.

I. Flame Spectrum	II. Spark Spectrum	Intensity and Character		Osc. Freq.
Liveing	Salet	I.	II.	
	6920			14447
	6860			14573
	6780			14745
	6400			15620
6230	6230			16047
6090				16416
6010				16634
5570				17948
5320				18784

Gallium.

Lecoq de Boisbaudran, 'Compt. Rend.,' lxxxii. 168.
Liveing and Dewar, 'Proc. Roy. Soc. xxviii. 482.

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Lecoq de Boisbaudran *a*	Liveing and Dewar *b*	I.	II.	
4170	4170	10sc	r	23974*ab*
4030	4031	6sc	r	24803*ab*

Gold.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil. Trans.' 1864, p. 139.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Liveing and Dewar, 'Phil. Trans.' clxxiv. 2219, 1882.

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Liveing and Dewar *d*	I.	II.	
6710				1s		14899*a*
6670				1s		14988*a*
6660				1s		15011*a*
6457				1s		15483*a*
6428				1s		15552*a*
6304				1s		15858*a*
6291				1s		15891*a*
*6276	6276·7	6276·9		8sc		15927*bc*
5961	5960·2	5958·2		6sc		16776*bc*
*5954	5955·2	5954·4		6sc		16788*bc*
†*5920				1s		16887*a*
5880				1n		17002*a*
*5862				2s		17054*a*
*5835	5836·1	5837·7		10sc		17127*bc*
5790				1s		17266*a*
†5758				1s		17362*a*
*5653				1s		17377*a*
5580				1n		17916*a*
*5231	5230·2	5230·2		10sc		19114*bc*
†*5067				1s		19730*a*
*4811				1s		20780*a*
*4793	4792·1	4791·6		6sc		20863*bc*
*4489				3s		22270*a*
			3122·8			32012*d*
			2675·4		r	37358*d*
			2427·5		r	41181*d*

* Observed also in the Spark Spectrum of solution of Gold Chloride by Lecoq de Boisbaudran, who gives also lines at 5725, †5601, †5458, †5347, †5310, †5287, 5259, †5242, †5212, 5172, †5143, †5125, 4608, 4437, 4338, 4314, and 4064.

† Observed by Lecoq de Boisbaudran in the Flame Spectrum of Gold Chloride, as well as lines at 5477, 5437, 5418, 5364, 5328, 5263, 5222, 5179, 5158, 5102, 5080, 5044, 4996, 4516 4430.

Helium.

Cornu	Angström
5874·6	5874·9

Hydrogen.

Plücker, 'Pogg. Ann.' cvii. 497.
Plücker and Hittorf, 'Phil. Trans.' clv. p. 21, 1865.
Ångström, 'Pogg. Ann.' xci. 141, cxxiii.; 'Recherches sur le Spectre Solaire.'
Wüllner, 'Pogg. Ann.' cxxxv. 497; cxxxvii. 337, 1868; cxliv. 481; 'Wied Ann.' xiv. 355; 'Phil. Mag.' (4) xxxvii. 405; xxxix. 365; Festschrift (Bonn.).
Salet, 'Ann. Chim. Phys.' xxviii. 28, 1873.
Lockyer, 'Proc. Roy. Soc.' xxx. 31, 1879,
Vogel, 'Monatsb. Berl. Akad,' 1879, 586; 1880, 190; 'Ber.' xiii. 274.
Seabroke, 'Phil. Mag.' (4) xliii. 155.
Hasselberg, 'Bull. Acad. imp. St. Petersb.' xi. 307, 1880; 'Mém. Acad. imp. St. Petersb.' xxx. No. 7, 1882; xxxi. No. 14, 1883.
Huggins, 'Phil. Trans.' clxxi. (II.) p. 669, 1880.
Liveing and Dewar, 'Proc. Roy. Soc.' xxxv. 74.
Balmer, 'Wied. Ann.' (N. F.) xxv. 80, 1885.

Elementary Line Spectrum		Intensity and Character	Osc. Freq.
Ångström *a*	Vogel *b*		
6562·1		10s	15234*a*
4860·7		8s	20567*a*
4340·1		6s	23034*a*
4101·2		4s	24376*a*
	3969		25188*b*
	3887		25719*b*
	3834		26074*b*
	3795		26343*b*
	3769		26525*b*

Note.—Certain lines measured by Huggins in the photographic spectra of the stars are, in all probability, due to Hydrogen. They have the following wave-lengths—3767·5, 3745·5, 3730, 3717·5, 3707·5, 3699.

Hydrogen.

Compound Line Spectrum	Intensity and Character	Osc. Freq	Compound Line Spectrum	Intensity and Character	Osc. Freq.	Compound Line Spectrum	Intensity and Character	Osc. Freq.
Hasselberg			Hasselberg			Hasselberg		
6422·7	2	15565	6269·6	1	15945	6173·6	4	16193
6394·3	2	15634	6237·3	4	16028	6169·5	3	16204
6358·5	1	15722	6232·1	1	16041	6167·1	1	16210
6337 6	2	15774	6224·0	4	16062	6164·0	2	16218
6323·9	4	15808	6200·8	2	16122	6161 2	4	16226
6309·8	2	15866	6198·7	4	16128	6158·7	2	16232
6296·9	4	15876	6196·1	3	16134	6154·9	2	16243
6283·4	3	15910	6182·2	4	16171	6152·7	2	16248
6·0	1	15937	6175·6	2	16188	6150·7	2	16254

HYDROGEN—*continued.*

ound ne trum	Intensity and Character	Osc. Freq.	Compound Line Spectrum	Intensity and Character	Osc. Freq.	Compound Line Spectrum	Intensity and Character	Osc. Freq
lberg			Hasselberg			Hasselberg		
5·7	2	16267	5927·5	1	16866	5729·8	4	17447
3·3	2	16273	5924·2	4	16875	5726·6	4	17457
0·7	1	16280	5920·1	4	16887	5721·6	1	17472
8·8	1	16285	5915·6	4	16899	5714·2	2	17495
4·5	6	16296	5911·3	1	16912	5711·8	2	17502
6·6	4n	16317	5909·0	3	16918	5708·2	1	17513
1·0	6	16332	5904·7	1	16931	5702·3	3	17532
8·4	2	16339	5903·1	2	16935	5699·4	2	17540
2·0	1	16356	5900·0	2	16944	5696·1	2	17551
7·5	1	16369	5897·5	1	16951	5693·0	2	17560
7·7	2	16395	5895·4	1	16957	5688·1	4	17575
5·2	4	16402	5893·4	2	16963	5683·1	4	17591
3·0	1	16407	5891·2	1	16970	5681·6	4	17595
0·0	4	16416	5887·9	6	16979	5675·4	1	17615
3·9	1n	16432	5883·5	6	16992	5673·6	1	17620
0·0	5	16442	5878·1	4	17007	5671·9	2	17625
8·4	1	16447	5875·5	1	17015	5669·7	2	17632
3·8	3	16459	5871·4	4	17027	5666·4	2	17643
9·6	5	16468	5868·8	4	17034	5662·5	1	17658
6·8	3	16478	5863·9	2	17048	5660·8	3	17660
2·9	3	16489	5861·0	2	17057	5658·6	2	17667
5·7	2	16508	5859·3	1	17062	5656·7	2	17673
2·1	4	16518	5856·7	1	17071	5654·6	3	17679
7·2	3	16532	5851·0	2	17086	5651·5	2	17689
4·4	2	16539	5848·6	2	17093	5646·4	1	17705
2·3	2	16545	5846·8	1	17098	5645·2	1	17709
0·2	2	16551	5835·4	4	17132	5641·5	3	17721
1·1	6	16576	5832·3	3	17141	5633·4	3	17746
7·2	4	16586	5830·5	3	17146	5631·0	1	17753
2·9	4	16598	5824·0	1	17165	5629·3	3	17759
0·4	4	16605	5822·0	4	17171	5625·8	3	17770
7·5	6	16613	5818·8	3	17186	5622·9	1	17779
1·0	1	16631	5816·1	1	17189	5621·2	1	17784
6·4	1	16644	5814·5	3	17193	5619·1	2	17791
4·2	1	16650	5812·0	6	17201	5615·3	1	17803
2·3	4	16655	5804·5	2	17223	5610·8	4	17817
7·4	1	16669	5803·1	1	17227	5607·8	1	17827
3·7	3	16679	5799·9	2	17237	5602·5	2	17844
1·9	3	16684	5797·8	1	17248	5598·6	3	17856
9·9	3	16689	5795·2	1	17251	5595·6	4	17866
8·4	3	16694	5793·3	2	17256	5590·3	2	17883
2·2	4	16711	5790·5	2	17265	5578·3	2	17921
4·9	5	16732	5786·3	1	17277	5573·1	2	17938
9·2	3	16748	5784·5	4	17283	5571·2	2	17944
6·6	4	16755	5778·2	3	17301	5563·5	1	17969
2·6	3	16766	5773·8	4	17315	5560·8	1	17978
9·0	4	16776	5772·0	1	17320	5554·0	2	18000
5·5	1	16786	5765·4	3	17340	5551·5	3	18008
9·2	4	16804	5761·9	1	17350	5546·7	1	18024
6·8	4	16812	5759·4	4	17358	5542·3	3	18038
2·9	1	16822	5756·4	4	17367	5536·4	4	18057
1·2	1	16827	5739·6	1	17418	5532·8	1	18069
7·9	5	16836	5737·9	1	17423	5529·0	1	18081
5·4	1	16843	5734·8	4	17432	5526·0	2	18091
0·8	5	16856	5733·3	2	17437	5523·0	1	18101

HYDROGEN —*continued.*

Compound Line Spectrum Hasselberg	Intensity and Character	Osc. Freq.	Compound Line Spectrum Hasselberg	Intensity and Character	Osc. Freq.	Compound Line Spectrum Hasselberg	Intensity and Character	Osc. Freq.
5520·5	1	18109	5256·2	2	19019	5012·2	5	19945
5517·2	3	18120	5237·4	2	19088	5010·8	2	19951
5514·3	1	18129	5230·3	1	19114	5007·5	3	19964
5506·8	1	18154	5228·1	2	19121	5002·7	4	19983
5504·5	4	18162	5225·4	2	19132	4997·3	2	20005
5498·5	4	18181	5221·7	2	19145	4995·8	2	20009
5494·8	3	18194	5219·7	1	19153	4989·5	2	20036
5493·1	1	18199	5213·7	2	19175	4988·6	2	20040
5480·0	4	18243	5204·4	1	19209	4982·5	1	20064
5473·8	2	18263	5201·9	1	19218	4979·6	3	20076
5470·6	1	18274	5198·9	2	19229	4978·2	1	20082
5464·3	1	18295	5195·9	4	19240	4977·3	1	20085
†5459·9		18310	5190·1	1	19262	4975·6	1	20092
5456·2	1	18322	5187·6	1	19271	4972·5	4	20105
5454·0	1	18330	5180·1	2	19299	4968·4	3	20121
5451·5	2	18338	5174·3	2	19321	4966·1	3	20130
5445·9	1	18357	5170·9	1	19333	4960·4	1	20154
5439·0	1	18380	5168·1	1	19344	4956·0	3	20171
5433·8	4	18398	5164·6	1	19357	4954·9	3	20176
5430·0	1	18411	5156·2	1	19388	4952·0	1	20188
5427·8	1	18415	5153·9	2	19397	4944·2	1	20220
5425·0	4	18428	5146·5	3	19425	4941·7	1	20229
5419·0	4	18448	5142·8	3	19439	4938·8	2	20242
5417·4	2	18454	5136·6	1	19462	4935·8	1	20254
5409·3	1	18481	5133·7	1	19473	4933 5	5	20263
5408·2	1	18485	5131·5	1	19482	4931·5	2	20272
5406·3	1	18491	5127·3	1	19498	4927·9	5	20286
5404·5	1	18498	5122·6	2	19516	4924·8	2	20299
5400·5	2	18511	5120·6	1	19523	4923·6	1	20304
5398·6	2	18518	5113·3	3	19551	4918·4	2	20326
5397·6	1	18521	5108·5	2	19569	4908·2	2	20368
5394·2	1	18533	5106·5	2	19577	4905·5	2	20379
5391·7	1	18542	5102·8	3	19591	4901·0	1	20398
5390·5	1	18546	5099·1	1	19606	4900·2	1	20401
5387·5	4	18556	5095·6	1	19619	4895·6	2	20420
5386·1	2	18561	5094·2	1	19624	4890·5	2	20442
5372·6	2	18607	5089·5	1	19643	4887·7	1	20454
5365·0	3	18634	5084·6	4	19661	4885·5	2	20463
5355·8	1	18666	5081·0	3	19675	4883·1	2	20473
5343·2	1	18710	5079·8	3	19680	4877·2	1	20498
5335·8	3	18736	5074·9	2	19699	4875·2	3	20505
5331·1	1	18752	5071·8	2	19711	4872·4	3	20518
5321·4	1	18786	5069·5	2	19720	4868·8	1	20532
5319·6	1	18793	5067·5	4	19728	4866·4	1	20543
5317·3	2	18801	5063·3	4	19744	Hβ4860·6		20568
5313·2	1	18815	5061·2	2	19752	4855·8	2	20588
5308·4	2	18832	5054·2	5	19780	4848·6	3	20619
5302·6	4	18853	5048·7	2	19801	4842·7	2	20644
5290·8	3	18895	5047·1	2	19807	4841·5	2	20649
5283·6	3	18921	5040·9	3	19837	4837·3	3	20667
5277·8	1	18942	5038·9	3	19840	4822·2	2	20731
5272·0	3	18962	5029·6	3	19876	4812·9	2	20771
5265·8	3	18985	5019·8	1	19915	4796·8	3	20841
5263·6	3	18993	5015·9	3	19931	4796·1	2	20844
5260·9	2	19002	5014·1	4	19938	4793·0	2	20858

HYDROGEN—*continued.*

Compound Line Spectrum Hasselberg	Intensity and Character	Osc. Freq.	Compound Line Spectrum Hasselberg	Intensity and Character	Osc. Freq.	Compound Line Spectrum Hasselberg	Intensity and Character	Osc. Freq.
4789·9	2	20871	4667·0	1	21421	4542·9	2	22006
4788·4	2	20878	4664·9	2	21430	4538·4	2	22027
4785·0	2	20893	4662·3	3	21442	4537·1	2	22034
4783·7	2	20898	4660·7	2	21450	4533·7	3	22051
4781·7	1	20907	4659·6	2	21455	4532·1	2	22059
4779·8	2	20915	4652·3	3	21488	4528·1	2	22078
4776·4	2	20930	4644·4	1	21525	4523·0	2	22102
4772·9	1	20946	4633·6	1	21575	4522·3	2	22106
4769·6	1	20960	4633·1	5	21577	4520·4	1	22116
4762·5	3	20992	4630·7	4	21588	4514·8	1	22143
4742·5	2	21080	4626·9	4	21606	4509·8	1	22168
4741·9	2	21082	4624·4	3	21618	4504·9	1	22192
4740·3	1	21089	4619·9	1	21639	4501·0	1	22211
4722·3	3	21170	4617·5	3	21650	4497·5	1n	22228
4720·4	1	21178	4616·8	3	21653	4492·8	1	22251
4718·3	4	21188	4606·6	2	21701	4489·7	3	22267
4713·4	4	21210	4582·0	3	21818	4485·2	2	22289
4710·3	1	21223	4580·8	1	21824	4476·6	1	22332
4708·7	3	21231	4579·4	4	21830	4473·7	3	22346
*4701·6	1	21263	4577·1	2	21841	4466·6	3	22382
4691·2	2	21310	4574·8	3	21852	4460·6	3	22412
4689·4	2	21318	4571·7	4n	21867	4458·5	1	22423
4686·0	2	21334	4567·2	4	21888	4456·4	2	22433
4685·5	2	21336	4564·4	1	21902	4455·3	1	22439
4683·7	1	21344	4562·9	2	21909	4452·6	1	22452
4683·0	3	21347	4561·4	2	21916	4450·3	1	22464
4681·7	2	21353	4557·8	2n	21934	4449·2	1	22469
4679·6	2	21363	4556·5	2n	21940	4447·2	3	22479
4678·3	2	21373	4553·3	3	21955	4444·7	3	22492
4674·6	2	21386	4550·3	2	21970	4443·6	1	22498
4674·0	2	21389	4549·0	1	21976	4417·0	2	22633
4672·5	1	21395	4547·1	1	21985	4412·0		22659
4670·7	2	21404						

* Double. † Probably due to Mercury.

A later series of observations by Hasselberg on the second spectrum of Hydrogen will be found in the 'Bull. Acad. imp. St. Petersb.' xi. 203, 1884.

Indium.

Reich and Richter, 'Journ. prak. Chem.' lxxxix, 441.
Müller, 'Pogg. Ann.' cxxiv. 637.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Clayden and Heycock, 'Phil. Mag.' v. II. 387, 1876.
Liveing and Dewar, 'Proc. Roy. Soc.' xxviii. 367, 1879.
Hartley and Adeney, 'Phil. Trans.' clxxv. 63, 1883.

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Thalén *a*	Clayden and Heycock *b*	Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.	
	6906			6s		14476*b*
	6193			10s		16143*b*
	6114			2n		16355*b*
	6095			8n		16402*b*
	5922			4n		16881*b*
	5905			4n		16930*b*
	5862			2n		17054*b*
	5820			8n		17177*b*
	5722			4n		17471*b*
	5644			8n		17713*b*
	5250			10n		19042*b*
	4680	4681·5		8sd		21354*c*
	4656	4655·2		8sd		21475*c*
	4638	4637·0		8sd		21559*c*
4531·6	*4532			8n		22061*a*
§4509·6	4510	4510·2	(4509·6)	10sc	r	22167*ac*
		4253·1		7sd		23505*c*
§4101·0	4101	4101·3	(4101·0)	9sc	r	24376*ac*
		4071·6		9sd		24553*c*
		4063·5		9sd		24602*c*
		4032·7		9sd		24790*c*
		4025·6		5sd		24834*c*
		3852·8		9sd		25947*c*
		3840·5		5sd		26030*c*
		3834·7		9sd		26069*c*
		3794·8		2nd		26344*c*
		3359·5		2nd		28086*c*
		3257·8		9sc		30686*c*
		3255·5		10nc		30708*c*
		3246·1		3sc		30797*c*
		3236·2		3sc		30891*c*
		3186·2		3sd		31376*c*
		3159·7		3nd		31639*c*
		3148·6		3nd		31750*c*
		3038·7		10b'c		32899*c*
		3008·0		9nd		33235*c*
		2982·3		9nd		33521*c*
		2956·1		2sc		33818*c*
		†2940·8		9b'c		33994*c*
		†2932·3		7sc		34092*c*
		2889·8		9sd		34594*c*
		2857·1		2sc		34989*c*
		2839·2		1sc		35210*c*
		2836·0		2sc		35250*c*
		2832·1		1sc		35298*c*
		2752·8		5sc		36315*c*
		2750·7		3nd		36343*c*

INDIUM—*continued.*

Spark Spectrum Hartley and Adeney	Intensity and Character	Osc. Freq.	Spark Spectrum Hartley and Adeney	Intensity and Character	Osc. Freq.
2738·1	2sd	36510	2423·2	3sd	41254
2727·0	2nd	36658	2422·8	3sd	41261
2712·9	3sc	36850	2416·3	3sd	41372
2709·3	7sc	36889	2403·5	3sd	41592
2706·4	1sc	36939	2397·6	3sd	41695
2631·2	3nd	37994	2389·8	2sc	41830
2610·8	1sc	38305	2388·0	2sd	41862
2602·5	3sc	38413	2385·9	3sd	41899
2600·2	3sd	38447	2381·0	3sd	41985
2591·0	3sd	38583	2370·7	3sd	42167
2586·6	3sd	38649	2357·0	2sd	42414
2564·7	3sd	38979	2355·8	1sc	42436
2559·5	7sc	39058	2355·4	2sd	42443
2554·1	3sd	39140	2353·8	2sd	42472
‡2545·8	2sd	39268	2351·3	7sd	42517
2527·1	7sd	39559	2332·2	2sc	42865
2520·9	3sc	39656	2306·9	9sc	43334
2492·7	2sd	40104	2289·3	2sd	43668
2485·5	2sd	40220	2287·8	2sd	43697
2485·1	2sd	40227	2264·4	3sd	44148
2478·3	1nd	40337	2263·8	3nd	44160
2470·2	5sd	40469	2249·2	3sd	44446
2468·4	3sc	40502	2245·7	3sd	44516
2462·5	2nd	40596	2205·5	2sd	45327
2460·8	5sc	40624	2202·0	2nd	45399
2460·3	2nd	40632	2194·0	3sd	45564
2447·4	2nd	40846	2191·2	3sd	45623
2443·7	2nd	40908	2181·0	3sd	45836
2433·6	3nd	41078	2155·8	2nd	46371
2431·0	3nd	41125	2137·8	2sd	46762
‡2429·0	1sc	41156	2078·1	2nd	48105
2428·6	3sd	41162			

* A line observed here when the Spark was taken from the Chloride or Nitrate, but not from the metal itself.

† See Tellurium. ‡ See Tin.

§ 4511 and 4101, Lecoq de Boisbaudran; observed in the Flame Spectrum of Indium Salts, and in the Spectrum of the Spark between metallic poles.

Iodine.

Plücker, 'Pogg. Ann.' cvii. p. 638, 1859.
Wüllner, 'Pogg. Ann.' cxx. p. 158, 1863.
Mitscherlich, 'Pogg. Ann.' cxxi. p. 474, 1864.
Plücker and Hittorf, 'Phil. Trans.' clv. p. 24, 1865.
Salet, 'C. R.' lxxiv. p. 1249; lxxv. p. 76; 'Ann. Chim. Phys.' (4) xxviii. p. 29, 1873.
Ciamician, 'Wien. Ber.' lxxviii. (II.) p. 877, 1878.

Spark Spectrum		Intensity	Osc. Freq.	Spark Spectrum		Intensity	Osc. Freq.
Plücker *a*	Salet *b*			Plücker *a*	Salet *b*		
6861		2	14571*a*	5377	5370	6	18604*ab*
6825		2	14648*a*	5365		8	18634*a*
6757		2	14795*a*	5339	η 5348	10	18709*ab*
6690		2	14943*a*	5330	η 5338	10	18742*ab*
6640		2	15056*a*	5314		2	18812*a*
6576		2	15202*a*	5292		2	18891*a*
6494		2	15394*a*	5262		4	18998*a*
6339		2	15771*a*	5257		4	19016*a*
6292		2	15889*a*	5235	5243	10	19082*ab*
6257		4	15977*a*	5218		2	19158*a*
6210	6210	4	16098*ab*	5209		6	19192*a*
6169		2	16205*a*	5176		2	19314*a*
6154		2	16245*a*	5166		2	19352*a*
6131	α6130	8	16307*ab*	5150		2	19412*a*
6087		2	16424*a*	5138	μ5158	10	19419*ab*
6073	β6075	9	16459*ab*	5107		2	19575*a*
6067		2	16478*a*	5102		2	19594*a*
5956	γ5960	10	16779*ab*	5064	ν5065	8	19739*ab*
5920		2	16887*a*	5047		2	19808*a*
5889		2	16976*a*	5028		2	19883*a*
5866		1	17042*a*	4990		2	20034*a*
5821		2	17174*a*	4972		2	20107*a*
5790	5790	5	17266*ab*	4960		2	20155*a*
5777	δ 5780	10	17300*ab*	4946		2	20212*a*
5763	δ 5765	10	17344*ab*	4922		2	20310*a*
5739	δ 5740	10	17418*ab*	4886		2	20460*a*
5713	δ 5715	10	17495*ab*	4853		4	20600*a*
5705		2	17523*a*	4838		1	20664*a*
5696	5695	9	17552*ab*	4832		1	20689*a*
5683	5685	10	17588*ab*	4809		2	20788*a*
5649		2	17697*a*		4675		21384*a*
5632	ε5630	10	17753*ab*		4666		21426*a*
5620	5620	3	17788*ab*	4636	π4634	6	21569*a*
5607	5610	3	17825*ab*		4480		22315*a*
5600		2	17852*a*		4470		22365*a*
5558		2	17987*a*		4455		22440*a*
5530		2	18078*a*		4450		22465*a*
5511		4	18134*a*				
5499	5496	9	18185*ab*				
5494	ζ	2	18196*a*				
5482	ζ	2	18236*a*				
5468	ζ 5470	10	18279*ab*				
5460	ζ	2	18310*a*				
5441	5447	10	18363*ab*				
5422		2	18438*a*				
5402	5407	10	18498*ab*				

Iridium and Ruthenium.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Lockyer, 'Phil. Trans.' 1881, p. iii.

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Kirchhoff	Lockyer	I.	II.	
6347·1				15751
5449·7		2		18344
5299·2		2		18865
	3991·5			25046
	3975·3			25148
	3945·1			25340
	3934 0			25412
	3914·5			25538
	3901·8			25621

Iron.

chhoff, 'Abh. Berl. Akad.' 1861.
ggins, 'Phil. Trans.' 1864, p. 139.
ılén, 'Nova Acta Soc. Upsal.' (III.) vi.
gström, 'Recherches sur le Spectre Solaire,' 1868.
scart, 'Annales de l'Ecoles normale,' t. iv. 1866.
chi, 'Compt. Rend.' lxxvii. 173, 1873.
oq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
nu, 'Spectre normal du Soleil'; 'Ann. de l'Ecole normale,' 2nd ser. t. ix. 1880; 'Les aies telluriques'; 'Journ. de l'Ecole polytechnique,' liii. 1883.
eing and Dewar, 'Phil. Trans.' clxxiv. p. 210, 1883; 'Proc. Roy. Soc.' June 2, 1881.
kyer, 'Phil. Trans.' 1881, pt. iii.
ılén, 'Le Spectre du Fer.' 1884.

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
ıggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
			7591·6				1	13169
			7535·0				1	13268
			7513·4				6	13306
			7498·3				6	13332
			7448·1				6	13422
			7413·1				6	13486
			7390·6*				6	13527
			7351·5				2	13598
			7316·5				1	13664
			7307·1				2	13681
			7304 0				1	13687
			7290·1				3	13713
			7284·9				2	13723
			7280·7				1	13731
			7258·8*				1	13772
			7242·5				1	13803
			7237·6				2	13813
			7221·4				2	13844

* Calcium: 7323·0, 7277·1.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
			7217·2				1	13852
			7204·9				4	13875
a			7185·5†				8	13913
			7180·1				3	13923
			7175·3				1	13933
			7162·8				4	13957
			7154·4†				1	13973
			7142·4				1n	13997
			7125·5				1	14030
			7102·1				1	14076
			7095·6				1	14089
			7074·4*				4	14131
			7052·8				1	14175
			7047·9				4	14184
			7027·1				1n	14226
			7020·7				4	14239
			7014·9†				1n	14251
			7008·9				1	14263
			7008·5				4	14264
			7002·0				4	14277
			6997·3				1	14287
			6994·6				1	14292
			6987·1				4	14308
			6978 3				1	14326
			6971 1				5	14341
			6957·4				1	14369
			6948·9				4	14387
			6945·6				1	14393
			6943·1				6	14399
			6927·7				1	14430
			6915·2				6	14457
			6901 5				2n	14487
			6898·2				1	14492
			§6894·2				4	14522
			6880·6†				2	14529
B			6875·5‡				1	14540
			6860·1				2	14573
			6856·4				4	14581
			6853·4				6	14587
			6842·1				6	14611
			6839·9				6	14616
			6837·5				1	14621
			6835·7				1	14625
			6826·4				6	14645
			6818·5				2	14662
			6808·5				4	14683
			6805·8				1	14689
			6802·3				2	14697
			6789·7				2	14724
			6784·8				2	14734
			6781·2				1	14742
			6774·7‡				1	14757
			6753·6				1	14802

* = Ba ?
Barium : 6870·0, 6865·0, 6770·3.

† Calcium : 7199·3, 7146 2, 7111·2, 7040·0, 6877·0.
§ The more refrangible of the solar pair.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
uggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
			6750·7				2	14809*d*
			6748·6				5	14813*d*
			6736·9				1n	14839*d*
			6731·8				2	14852*d*
			6725·2				4	14865*d*
			6714·3				2	14889*d*
			6711·8				4	14894*d*
			6704·0				3	14912*d*
			6702·3				2	14916*d*
			6698·1				1	14925*d*
			6694·4‡				1	14933*d*
			6676·9‡				10	14973*d*
			6666·6				1	14996*d*
			6662·5					15005*d*
			6652·8				2	15027*d*
			6645·7				1	15043*d*
			6638·4				2	15060*d*
			6632·7				6	15073*d*
			6626·5†				2	15086*d*
			6608·7				4	15127*d*
			6604·2				1	15138*d*
			6596·8‡				4	15155*d*
			6594·3				4	15160*d*
			6592·2				10	15165*d*
			6580·3				1	15192*d*
			6573·6†				4	15208*d*
			6568·2				8	15220*d*
			6555·6				1	15250*d*
			6545·1				10	15274*d*
			6533 0				4	15302*d*
			6527·7‡				1	15315*d*
			6517·3				6	15339*d*
			6508·3				4	15361*d*
			6503·3				4	15372*d*
			6500·7				4	15378*d*
			6498·3				4	15384*d*
			6496·1				4	15389*d*
			6494·2‡				10	15394*d*
6497	6490·1	6489·7	6489·9§			6sd		15406*bcd*
			6481·0‡				4	15425*d*
			6474·8				4	15440*d*
			6468·5				4	15455*d*
6460			6461·7		6461·7	1s	5	15471*df*
			†6455·2				1	15487*d*
			6430·1				8	15547*d*
			6420·6				8	15570*d*
			6419·2				6	15573*d*
6414			6410·9			1s	8	15594*d*
			6407·2		6407·4		6	15603*df*
6401						1s		15618*a*
6400	*6399·3	(6399·4)	6399·3			10nc	10	15622*bd*

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† Calcium : 6716·4, 6616·5, 6571·0, 6508·0, 6498·0, 6492·7, 6470·4, 6461·3, 6454·3, 6449·0, 6438·0.
‡ Barium : 6692·0, 6674·0, 6595·3, 6526·0, 6495·3, 6483·0. § Angström ; 'does not exist,' Thalén.

IRON.—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Fr-q.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Angström and Thalén *d*	Fievez and Thalén *e*	Cornu *f*	I.	II.	
			6392·6				8	15638*d*
6386						ls		15655*a*
			6379·7	6379·5			4	15670*de*
			6375·0	6373·5			1	15684*de*
			6363·5	6362·7			2	15711*de*
			†6361·2	6360·6			2	15716*de*
6360			6357·7	6357·3		ls	4	15725*de*
			*6354·0	6354·0			4	15733*de*
			†6343·2	6344·0			4	15759*de*
			‡6341·0 ?				1	15768*d*
			6338·0	6338·0			2	15773*de*
6338			6335·9	6336·0		ls	8	15778*de*
			6334·3	6334·3			8	15782*de*
			6330·5	6329·0			2n	15794*de*
6320			6321·6	6321·6		ls	6	15814*de*
			†6316·9	6317 4			10	15825*de*
			§6313 9	6313·4			4	15834*de*
			6311·0				2	15841*d*
			6309·5	6309·1			2	15845*de*
			6306·0	6305 7			1	15854*de*
			6303·5				1	15859*d*
			6301·6	6302·0			6	15864*de*
6306	*6300·6	6301·4	6300·7	6300·5		6sd	10	15867*bcd*
			6296·9	6297·0			6	15876*de*
			6293·0				1n	15886*d*
			6292·0				1	15888*d*
			6290·2				4n	15893*d*
			6288·0				1n	15899*d*
			6284·5				1n	15908*d*
			6281 6				2	15915*d*
			6279 6				4	15923*d*
a			6276·6				1	15928*d*
			6269·9				2	15945*d*
			6269·1	6269·2			4	15945*de*
			†6264·7	6264·0			6	15959*de*
6254			6255·3	6255·1		ls	6	15982*de*
			6253·2	6253·0			6	15987*de*
			6251·5	6251·2			10	15992*de*
6246	*6245·6		6245·4	6245·4		8sd	8	16007*bde*
			6239·2	6239·0			2	16023*de*
			6231·5	6231·5			6	16043*d*
6231	*6229·9	(6229·9)	6229·7	6229·5		8sc	10	16047*bd*
			6225·4	6225·3			1	16059*de*
			6219·7	6220·0			1	16073*de*
			6218·3	6218·2			5	16077*de*
			6214·1	6215·0			4	16087*de*
			6212·3	6212·4			5	16092*de*
			6199·6	6199·2			4	16126*de*
6190	*6190·7	(6190·7)	6190·5	6190·7		8sc	10	16148*bde*
			6187·1	6186·9			2	16158*de*
			6185·3	6185·6			1	16162*de*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† Calcium : 6361·2, 6344·0, 6318·0, 6260·0, 6168·7, 6168·0, 6165·5.
‡ Barium : 6340·5.
§ Solar line double : the iron line is the least refrangible.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Angström and Thalén *d*	Fievez and Thalén *e*	Cornu *f*	I.	II.	
			6183·0				1	16169*d*
			6179·3	6179·2			4	16178*de*
			6172·3	6172·3			4	16197*de*
			6169·4	6169·8			5	16204*de*
			†6163·8	6163·3			2	16220*de*
			†6162·3				1	16223*d*
			6156·7	6156·7			6	16238*de*
			6150·5	6150·5			4	16245*de*
			‡6148·1	6146·6			4	16262*de*
			6136·6	6136·8			10	16291*de*
6138	6135·8	(6135·8)	6135·6	6135·5		8sc	10	16293*bde*
				6130·3			1	16308*e*
			6126·8	6126·7			6	16322*de*
			†6122·0	6122·0			1	16330*de*
			6115·3	6115·1			2	16348*de*
				‡6112·0			1	16356*e*
				6107·0			1	16360*e*
			6102·2	6101·8			10	16383*de*
			†6101·2	6100·8			10	16386*de*
			6097·4	6097·0			1	16396*de*
			6095·7	6095·1			3	16401*de*
			6093·3	6092·8			1	16407*de*
			6092·7	6092·1			1	16409*de*
			6088·2	6088·1			3	16420*de*
			6084·4	6084·0			2	16431*de*
			6081·9	6081·3			2	16438*de*
				6080·0			1	16443*e*
			6077·6	6077·2			4	16450*de*
6080 ?	6064·7	6064·1	6064·5	6064·5		8sd	8	16484*bde*
				‡6061·4 ?			1	16493*e*
			6055·1	6055·0			6	16510*de*
			6053·1				1	16516*d*
			6041·2	6041·1			4	16541*de*
			6035·0	6035·0			1	16565*de*
			6033·0	6033·0			1	16571*de*
				6029·0			1	16581*e*
			6026·0	6026·0	6026·1		6	16590*def*
6020	6023·2	(6023·2)	6023·0	6023·0	6023·2	6sc	10	16598*bdef*
	*6019·3		6019·1	6019·2	6019·2	4sc	8	16609*bdef*
			6011·2	6011·5			1	16630*de*
	6007·5		6007·5	6007·3	6007·6	4sd	6	16641*bdef*
			6005·0	6006·7			2	16645*de*
				6003·9			1n	16651*e*
	6002·3		6002·1	6002·0	6002·0	4sd	6	16656*bdef*
				5998·6			1	16666*e*
			5996·9	5997·0			3n	16670*de*
	5986·4		5986·2	5986·2	5986·0	4sd	6	16700*bdef*
	5984·4		5984·2	5984·2	5983·7	4sd	8n	16706*bdef*
	5983·0		5982·8	5982·7	5982·6	4sd	6n	16719*bdef*
	5976·3		5976·0	5976·0	5975·6	4sd	6	16728*bdef*
	5974·8		5974·6	5974·3	5974·2	4sd	6	16733*bdef*

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† Calcium : 6163·6, 6161·1, 6121·2, 6101·2. ‡ Barium : 6140·4, 6109·8, 6062·0.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Angström and Thalén *d*	Fievez and Thalén *e*	Cornu *f*	I.	II.	
				5966·5			1n	16755*e*
				5961·3			1	16770*e*
				5959.5			1	16775*e*
			5957·1	5957·4			1	16781*de*
5958			5955·0	5956·0	5955·7	1s	4	16785*def*
			5951·6	5951·6	5951·9		6	16797*def*
		*5915·1	5948·5	5948·6	5947·7		8n	16806*def*
			5940·8	5941·6	5941·3		1	16826*ef*
				5940·0	5939·8		2	16830*ef*
			5933·9	5933·0	5933·5		6	16842*def*
			5929·3	5928·7	5929·0		10	16861*def*
			5927·2	5926·2			2	16868*de*
			5915·7	5915·6	5915·0		2	16900*def*
			5913·2	5913·4	5913·0		10n	16906*def*
			5909·4	5909·0			1	16918*de*
				5906·7			1	16925*e*
5902			5904·4	5904·3	5904·5	1s	4n	16932*def*
			5901·3	5901·3			1	16941*de*
				5900·3			1	16943*e*
				5898·0			1	16950*e*
			5897·0	5897·0			1n	16953*de*
			5892·0	5892·0			2	16976*de*
			5890·6	5890·6			1	16971*de*
				5889·9			1	16973*e*
				5884·4			1	16989*e*
*5880			5883·0	5882·5	5882·8	1s	3	16994*def*
				5880·6			1	17000*e*
			5878·3	5878·2			1	17007*e*
				5878·0			1	17008*e*
			5877·0	5876·0			1	17012*de*
			5874·0	5872·0			2	17027*de*
			5861·5	5861·4			7	17056*de*
5855			5858·4	5858·5		1s	6	17064*de*
			†5855·5	5855·2			3	17073*de*
				5854·2			1	17077*e*
				‡5852·2			1	17083*e*
			5851·3	5851·0			3	17086*de*
			5848·5	5848·5			1	17093*de*
			5847·4	5847·2			2n	17097*de*
			5837·0	5835·8			1	17129*de*
				5835·1			1	17133*e*
			5832·5	5833·5			1n	17139*de*
			5827·5	5827·5			1n	17155*de*
				5825·0			1	17162*e*
			5815·5	5815·5			6	17190*de*
			5814·0	5813·6			1	17195*de*
			5811·0	5810·5			1	17205*de*
			5808·3	5808·0			2	17212*de*
				5806·7			1	17216*e*
			5805·8	5805·8			4	17219*de*
			*5803·5	5803·2			2	17226*de*
				5802·8			2	17228*de*

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† Calcium : 5856·4. ‡ Barium : 5852·7.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
iggins *a*	Thalén *b*	Kirchhoff *c*	Angström and Thalén *d*	Fievez and Thalén *e*	Cornu *f*	I.	II.	
				5800·0			1n	17236*de*
			5797·3	5797·3			3	17244*de*
			5793·0	5792·2			3	17258*de*
			*5790·1	5790·1			4	17266*de*
				5789·8			2n	17267*e*
			5784·7	{ 5784·5			1	17283*e*
				{ 5784·2			1	17283*e*
				5783·4			1	17286*e*
5780			5781·3	5781·6		1s	2	17292*de*
				5780·0			4	17296*e*
			5777·5	5778·5			2	17302*de*
			5776·0				1	17308*d*
			5774·1	5774·0			5	17314*de*
				5769·7			1n	17330*e*
	*5762·0	(5762·0)	5761·9	5762·0			8	17350*bde*
				5759·6			2	17357*e*
				†5758·2			1	17361*e*
				5756·0			2n	17368*e*
				5753·9			2	17374*e*
			5752·0	5752·0			6	17380*de*
			5751·0	5751·0			3	17383*de*
			5746·7	5746·5			3	17397*de*
				5741·8			1	17411*e*
				5740·9			4	17414*e*
				5739·5			1	17418*e*
				5736·8			1	17426*e*
			‡5730·5	5730·5			6	17445*de*
			5727·0	5728·0			1n	17460*de*
			5723·0	5722·5			1n	17468*de*
			5720·0	5719·8			1n	17478*de*
			5716·8	5716·5			6	17488*de*
			5715·2				2	17492*d*
			5713·8	5714·0	5714·1		2	17496*def*
			5713·3	5713·3			1	17498*de*
				5711·0			4	17505*e*
			§5710·8	5710·7			4	17506*de*
	*5708·4		5708·3	5708·5		6sd	10	17513*bd*
			5707·1	5707·1			1	17517*de*
			5706·0	5706·0			1	17520*de*
			5705 0	5705·0			3	17523*de*
			5700·4	5700·5			8	17537*de*
			5697·2	5697·5			1	17546*de*
				5695·5			1	17552*de*
			5692·8	5693·0			4	17560*de*
			5690·6	5690·8			4	17567*de*
			5685·5	5685·3			6	17583*de*
	5681·5			5685·2		6sd	2	17594*e*
			5679·0	5679·2			1	17603*de*
			5677·9	5678·0			4	17607*de*
			5671·0	5670·5			1n	17629*de*
				5669·1			1n	17634*e*

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† Calcium : 5756·5. ‡ Sodium. Liveing and Dewar. § Magnesium. Liveing and Dewar.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins	Thalén *b*	Kirchhoff *c*	Angström and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I	II.	
			5666·0	5666·6			2	17643*de*
				5663·0			1	17653*e*
	5661·6		5661·6	5661·5		6sd	6	17657*bde*
				5660·3			1	17662*e*
				5659·7			1	17664*e*
	*5657·7		5657·6	5657·9		10sc	8	17670*bde*
	5654·5		5654·4	5654·6		6sd	4	17680*bde*
			5651·6	5652·5			1	17689*de*
				5650·4			2	
				5649·5			1	17695*e*
				5648·8			1	17698*e*
			5648·0	5648·0			2n	17700*de*
				5647·5			1	17702*e*
				5644·0			1	17712*e*
			5643·0	5642·7			2	17716*de*
				5642·0			1	17719*e*
			5640·2	5640·5			4	17724*de*
				5639·5			1	17727*e*
			5637·2	5637·3			6	17734*de*
				5636·0			1	17738*e*
				5635·2			1	17740*e*
				5634·0			1	17744*e*
			5632·7	5632·5			4	17749*de*
				5631·0			1	17753*e*
			5624·4	5624·1			1	17775*de*
5624	*5623·3	5623·3	5623·2	5623·5		6sd	8	17778*bode*
			5619·3	5619·4			2	17790*de*
			5618·0	5618·5			1	17794*de*
				5617·7			3	17796*e*
			5616·1	5616·0			1	17801*de*
5612	*5614·6	(5614·6)	†5614·5	5614·6	(5614·6)	10sc	10r	17805*bde*
				5611·0			1	17817*e*
				5609·2			1	17822*e*
				5607·8			1	17827*e*
				5605·8			1	17833*e*
5601	*5601·8	(5601·8)	5601·7	‡5601·5		10sc	8	17846*bde*
			5598·9	5598·6			2	17856*de*
5594	5597·3		5597·2	‡5597·2		10sc	3	17861*bde*
			5593·4	‡5593·3			4	17875*de*
	5591·3		5591·3	5590·8		8sc	1	17880*bde*
				‡5588·7			1	17888*e*
5584	*5585·7	5585·3	5585·6	5585·4	(5585·7)	10sc	10r	17898*bode*
			5583·8	5583·3			1	17905*de*
			5577·6	5578·0			1	17923*de*
	*5575·0	(5575·0)	5574·9	5574·4		8sc	8	17933*bde*
5571	5571·8	(5571·7)	5571·7	5571·3		10sc	9	17943*bde*
5569	5568·6	5568·0	5568·5	5568·5		8sc	8	17953*bode*
			5566·4	5566·0			2	17960*de*
			5564·6	5564·2			5	17966*de*
			5562·7	5562·5			5	17972*de*
			5561·8	5561·4			2n	17975*de*

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† The least refrangible line of the solar triplet.
‡ Calcium : 5601·3, 5600·3, 5597·8, 5593·4, 5588·9, 5587·5, 5580·7

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
iggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
			5559·3	5559·0			2n	17983*de*
			5557·1	5556·7			2n	17990*de*
			5553·9	5554·0			6	18000*de*
			5552·7	5552·4			2	18005*de*
			5590·0	5549·0			1	18016*de*
			5545·5	5545·7			1	18027*de*
				5545·3			2	18028*de*
			5542·7	5543·0			4	18036*de*
			5542·0	5542·0			4	18039*de*
				5540·0			1	18045*e*
				5537·7			1	18053*e*
			§‖5536·3	5537·2			2n	18057*de*
			5531·5	5531·8			4	18073*de*
				5529·7			1	18079*e*
				5528·4			2	18083*e*
			5524·7	5524·4			6	18096*de*
				5523·0			1	18101*e*
			5521·5	5521·5			4	18106*de*
			5520·0	5520·2			1b[r]	18110*de*
			‖5515·6	5516·5			1n	18124*de*
			5511·4	5511·2			2n	18139*de*
			5509·5	5509·2			2n	18146*de*
			5507·6	5507·2			2n	18152*de*
503	5506·0		5505·9	5505·9		8sc	8	18157*bde*
				5503·3			1	18166*e*
			5501·9	5502·0			4	18170*de*
	5500·6		5500·5	5500·5		6sc	6	18175*bde*
	5496·5		5496·6	5496·4		6sc	6	18188*bde*
			5493·5	5493·7			1	18198*de*
				5493·0			1	
			5492·5	5492·5			3	18201*de*
			5491·0	5490·8			1	18207*d*
			5489·0	5489·3			1	18213*de*
	5486·9		5486·8	5486·6		4sd	4n	18220*bde*
			5485·0	5484·0			1	18228*de*
			5482·4	5481·8			4	18236*de*
			5480·2	5480·2			4	18242*de*
			5479·9	5479·6			4	18244*de*
			5477·4	5478·0			2	18251*de*
			5475·9	5475·8			8	18257*de*
				5475·3			4	18259*e*
			5473·3	5473·6			4	18265*de*
			5472·0	5472·1			1	18270*de*
				5469·7			1	18277*e*
			5469·0	5469·1			1	18279*de*
				5466·2			2	18289*de*
			5465·6	5465·7			4	18291*de*
			5463·2	5463·4			2	18299*de*
				5462·6			4	18301*e*
460		5462·0	5462·3	5462·3		2s	6	18302*cde*
454	*5454·8	(5454·8)	5454·7	5454·7		10sc	10	18327*bde*
				5451·5			1	18338*e*

[r] Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
· Double. § The least refrangible of the solar pair. ‖ Barium : 5534·2, 5518·4.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Ångström and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
				5447·3			1	18352*e*
5444	*5446·0	5446·6	5445·9	5446·0	(5446·0)	10sc	10	18356*bcde*
		5444·7	5444·2	5444·3			4	18362*cde*
			5440·0	5440·7			1	18376*de*
				5438·0			1	18384*e*
				‖5436·0			1	18390*e*
			5435·4	5435·5			2	18392*de*
5432		5433·3	5433·0	5433·0		2s	10	18400*cde*
5426	*5428·9	(5428·9)	5428·8	‖5428·0	(5428·9)	10sc	10	18416*bde*
5424		5423·0	5423·6	5423·4		2s	10n	18434*cde*
				5419·2			1	18447*e*
			5416·0	5416·2			1	18458*de*
5412		5414·6	5414·5	5414.6		1s	10n	18463*cde*
5409		5410·0	5410·0	5410·0		1s	8	18479*cde*
			5408·5	5408·2			1	18484*de*
				‡5406·5			1	18491*e*
	*5404·9	(5404·9)	5404·8	5404·9	(5404·9)	8sc	10r	18496*bde*
5402	5403·2	(5403·2)	5403·1	5403·3		8sc	8	18502*bde*
			Vogel and Thalén					
5401			5399·6	5399·6		2s	4	18514*de*
			5397·3	5397·0			5	18522*de*
	5396·2	(5396·2)	5396·2	5396·0	(5396·2)	8sc	8	18526*bde*
5392	*5392·4	5392·0	5392·1	5392·3		6sc	8	18540*bcde*
5388			5390·4	5390·3			4	18546*de*
			5388·4	5388·8			7	18552*de*
			5386·6	5386·0			1	18560*de*
			5385·5	5385·0			1	18564*de*
5383	*5382·4	(5382·4)	5382·5	5382·4		6sc	8	18574*bde*
			5378·5	5378·0			4	18588*de*
			5376·5	5376·2			1	18594*de*
			5375·7	5375·2			1n	18598*de*
			5372·6	5372·5			4	18608*de*
†5370	*5370·6	5370·8	5370·5	5370·6	(5370·6)	10sc	10r	18614*bcde*
	5369·1	(5369·1)	5369·0	5369·0		6sd	8	18620*bde*
5366	5366·6	5366·7	5366·4	5366·6		6sd	8	18629*bde*
			5364·4	5364·3			4	18636*de*
5365	5364·1	5363·8	5363·9	5363·6		6sd	8	18637*bcde*
5363	5362·0		5361·9	5361·8		4sd	2	18644*bde*
			5360·8	5360·6			1	18649*de*
			5357·3	5357·3			7	18661*de*
				5355·0			1	18669*e*
	5352·5		5352·5	5352·5		4sd	7	18677*bde*
	5348·7		5348·8	§5348·7		4sd	2	18691*bde*
			5342·7	5342·4			2	18712*de*
	* 5340·3	(5340·3)	5340·3	5340·0		8sc	6	18720*bde*
	5339·3	(5339·3)	5339·2	5338·9		8sc	6	18724*bde*
			5332·1	5332·0			4	18742*de*
			5329·0	5329·1			2	18760*de*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride [illegible]
† Double. ‡ Possibly due to M
§ Calcium : 5348·4, the Iron line is the less refrangible of the solar pair.
‖ Barium : 5436·0, 5425·0, 5424·0.

IRON– *continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
5322	*5327·4	{5327·7 {5327·2	{5327·3 {5327·0	5327·6 5327·0	(5327·2)	10sc	6 10	18765*cde* 18766*cde*
				5326·6			1	18768*e*
				5325·9			1	18770*e*
				5325·2			1	18773*e*
5318	5323·5	(5323·4)	5323·2	5323·5		8sc	8	18779*bde*
			5321·4	5321·3			1	18783*de*
			5420·4	5320·3			1	18790*de*
			5319·3	5319·2			1	18794*de*
			5318·5	5318·0			1	18798*de*
5314	5316·0	5316·1	5316·1	5316·0		8sc	4	18805*bcde*
			5314·6	5314·5			2	18810*de*
5312	*5306·6		†5306·5	5306·6		6sd	6	18839*bde*
5299	5301·6	(5301·5)	†5301·5	5301·4		6sd	10	18857*bde*
			5299·4	5299·0			1	18865*de*
			5298·1	5298·2			2	18869*de*
			5294·9	5295·0			1	18880*de*
				5294·3			1	18883*e*
			5293·7	5293·9			2	18884*de*
			5292·7	5292·0			1	18889*de*
5289			5287·6	5287·6			4	18906*de*
			5284·2	5284·2			1	18919*de*
			5283 4	5283·8			1	18921*de*
†5282	{*5282·7 {5281·0	5283·0 (5281·0)	5282·7	5282·6		8sc	10	18924*bcde*
			5280·9	5280·8		6sd	8	18930*bde*
			5279·7	5279·0			1	18940*de*
5274			5275·2	5275·0		1s	2	18951*de*
			5274·5	5274·0			3	18954*de*
			5272·5	5272·3			6	18961*de*
E {5270	{*5269·6	(5269·6)	‡5269·2	§5269·5		10sc	10	18972*bde*
{5269	{5268·6	(5268·6)	5268·5	5268·6	(5268·6)	10sc	10	18975*bde*
5267	5265·9	5265·6	5265·3	§5265·5		8sc	10	18985*bcde*
5262	5262·5		5262·3	§5262·0		4sd	6	18997*bde*
			5256·8	5256·6			1	19018*de*
			5254·7	5254·7			1	19025*de*
5256			5253·9	5254·0		1s	3	19027*de*
			5252·4	5252·6			4	19033*de*
*5250			{5250·8	5251·0		1s	2	19039*de*
			{5249·4	5249·8			6	19043*de*
			5248·0	5247·9			1	19049*de*
			5246·2	5245·7			2	19057*de*
			5244·7	5244·0			1n	19062*de*
			5243·0	5242·8			1	19068*de*
5241			5241·8	5241·1		1s	6	19073*de*
			5253·4	5235·5			1	19095*de*
			5234·4	5234·7			3	19098*de*
			5233·6	5233·8			1	19101*de*
5232	*5232·2	(5232·1)	5232·1	5232·1		10sc	10	19107*bd*
			5229·0	5229·0			4	19119*de*
			5227·4	5227·6			1	19124*de*

* Observed [illegible] bandran in the Spark Spectrum of Ferric Chloride solution.
† Barlow
‡ Less refrangible than the Calcium line.
§ Cale[illegible]

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
5226	5226·4	(5226·4)	5226·4	5226·4 5226·0	‡(5226·0)	10sc	10r 6	19128*bde*
			5224·5	5224·8			2	12135*de*
			5222·3	5222·0			2	19144*de*
			5221·5	5221·4			1	19146*de*
				5220·8			1	19149*e*
			5220·2	5220·0			1	19151*de*
			5218·7	5217·7			1n	19158*de*
§5218			5216·7	5216·7		1s	6	19164*de*
			5215·6	5215·5			6	19168*de*
			5214·5	5214·5			6	19172*de*
				5211·0			1	19185*e*
			5209·5	5209·5			1	19190*de*
	*5207·8		‖5207·6	5207.8		6sd	8	19197*bde*
				5205·3			1	19206*e*
5202	5203·9		5203·8	5203·3		6sd	4	19212*bde*
	5201·7		5201·7	5201·4		4sd	8	19219*bde*
			5198·2	5198·2			6	19232*de*
			5195·3	5195·6			4	19241*de*
			5194·6	5194·7			5	19245*de*
	5194·3		5194·0	5194·2		6sc	8	19247*bde*
5192	*5191·9	(5191·9)	5191·4	5191·8		8sc	10	19256*bde*
5190	5190·7	(5190·7)	5190·6	5190·6		4sc	10	19260*bde*
			5187·2	5187·2			4	19273*de*
			5183·8	5183·8			4n	19285*de*
			5180·8	5180·7			1n	19297*de*
5180			5179·4	5179·4		1sc	2n	19302*de*
	5171·3	5170·9	5171·1	5170·9		4sc	10	19333*bcde*
$b_3$5168	†* 5168·5	(5168·5)	5168·4	5168·9		6sc	4r	19342*bde*
$b_4$5166	5166·9	(5166·9)	5167·0	5167·1	(5166·9)	8sc	10	19348*bde*
			5165·8	5165·7			3	19353*de*
			5164·8	5165·0			4	19356*de*
			5163·8	5164·2			1	19359*de*
	5161·8	(5161·6)	5161·6	5161·5		4sc	8n	19368*bde*
			5159·6				1d	19376*d*
			5158·3				2n	19381*de*
			5156·6				1d	19387*d*
			5156·0				1d	19389*d*
			5154·7				1d	19394*d*
			5153 7				1d	19398*d*
			5152·8				1d	19401*d*
			5151·5				6	19406*d*
			*5150·6				6	19410*d*
5148			5147·8			1s	5	19420*d*
			5146·4				1d	19425*d*
			5145·3				1	19430*d*
			5144·3				3	19433*d*
			5142·8				1d	19439*d*
			5141·9				5	19442*d*
			5141·6				4	19443*d*
			5140·8				4	19447*d*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† b_3, see Nickel; the solar line b_3 is double; b_4, see Magnesium; the solar line b_4 is double.
‡ Double. ‖ See Chromium; the solar line here is double.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Fievez and Thalén *e*	Liveing and Dewar *f*	I.	II.	
5139	*5138·8	5138·8	5138·5			8sc	10	19454*bcd*
			5136·3				6	19464*d*
			5135·4				1	19467
5133		(5133·0)	5133·0			2s	8	19476*d*
			5130·8				4	19484*d*
			5128·8				2	19492
			5126·4				6	19500*d*
			5125·3				2	19505*d*
			5124·4				8	19509*d*
			5123·1				6	19514*d*
			5120·9				4	19522*d*
			5114·6				2d	19546*d*
			5113·6				1d	19550*d*
			5109·2				8	19567*d*
	*5107·1		5107·2			6sc	8	19574*bd*
			5105·2				2d	19582*d*
			5104·0				1	19587*d*
			5103·7				1	19588*d*
*5099			5098·2			2n	8	19609*d*
			5096·6				6	19615*d*
			5090·3				6	19639*d*
			5087·7				2	19649*d*
			5085·7				1	19657*d*
			5083·8				1	19665*d*
			5082·8				8	19668*d*
			5080·6				1	19677*d*
			5080·2				1	19678*d*
			5079·4				4	19682*d*
			5078·8				8	19684*d*
			5075·7				3	19696*d*
			*5074·0		(5072)		8r	19702*d*
			5072·0				2n	19710*d*
			5071·3				2n	19713*d*
			5068·2				10	19725*d*
			5066·6		(5064·5)		4r	19731*d*
	*5064·5		5064·5			4sd	8n	19739*bd*
			5059·2				4n	19760*d*
			5057·5				1	19767*d*
			5056·5				1	19771*d*
			5055·8				1	19773*d*
			5055·3				1	19775*d*
			5053·9				2	19781*d*
			5052·8				1n	19785*d*
			5052·2				1n	19787*d*
	5051·1		5051·0			8sc	8	19792*bd*
	*5049·5		5049·4			8sc	10	19798*bd*
			5048·1				4	19804*d*
			5043·6				4	19821*d*
	5041·3		5041·0			6sc	8r	19831*bd*
	*5040·2		5040·3			6sc	8	19834*bd*
			5038·5				4	19841*d*
			5036·2				4	19850*d*
			5035·7				2n	19852*d*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4682·7				4	21349*d*
			4681·3				2	21355*d*
			4680·6				1	21358*d*
			4679·7				2	21362*d*
			4677·9				10	21371*d*
			4672·2				6b	21397*d*
			4668·3				5	21415*d*
			4667·2				10	21420*d*
			4665·5				10	21427*d*
			4664·9				2	21430*d*
			4662·3				1	21442*d*
			4661·2				2b^r	21447*d*
			4660·7				1	21450*d*
			4657·5				1	21464*d*
			4656·7				1	21468*d*
	4653·5		4653·7			6sc	10	21482*bd*
			4650·4				1	21497*d*
			4649·2				1	21503*d*
			4646·7				8	21514*d*
			4642·7				6	21533*d*
			4640·0				1n	21545*d*
			4637·3				8	21558*d*
			4636·7				8	21561*d*
			4635·0				4	21568*d*
			4633·9				2	21574*d*
			4633·0				1	21578*d*
	4632·1		4632·1			6sc	6	21582*bd*
			4629·3				6	21595*d*
			4626·6				1	21608*d*
			‡4624·3				8	21618*d*
			4618·6				8	21645*d*
			‡4618·1				2	21647*d*
			4614·8				1	21663*d*
			4613·3				1	21670*d*
			4612·5				6	21672*d*
	4610·7		4610·5			6sc	8	21682*bd*
			‡4607·0				6	21701*d*
			4603·7				2	21715*d*
	4602·7		4602·3			4sd	10	21721*bd*
			4601·3				4	21726*d*
			†4600·2				1	21732*d*
			4597·4				5	21745*d*
			4595·3				4	21755*d*
			4594·7				4	21758*d*
	4592·0		4591·9			6sc	8	21770*bd*
			4590·1				1	21779*d*
4582			‡4586·4			1s	4	21796*d*
			*4584·2				4	21807*d*
			4583·3				2	21812*d*
			‡4580·8				6	21824*d*
			4579·8					
			‡4579·4					

* The solar ray here is double, the less refrangible ray being due to Calcium.
‡ Calcium : 4622·4, 4616·6, 4606·7, 4585·3, 4580·8, 4578·0.

IRON.—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4574·2				4	21855*d*
			4572·2				1	21865*d*
			4571·1				1	21870*d*
			4568·2				4	21884*d*
			4566·3				2	21893*d*
			4565·8				1	21895*d*
			4565·0				2	21899*d*
			4564·2				2	21903*d*
			4560·7				1	21920*d*
			4559·4				2n	21926*d*
			4557·3				1	21936*d*
			‖4555·4				8	21945*d*
			4551·8				4	21963*d*
			4550·1				2	21971*d*
			4548·9				5	21977*d*
			4547·3				8	21984*d*
			4546·3				1	21989*d*
			4544·0				1	22000*d*
			4541·8				2n	22011*d*
			4538·0				2	22029*d*
			††‡4532·5				2	22056*d*
			4530·8				1	22065*d*
			4530·4				6	22067*d*
			4528·8				2	22075*d*
	4528·1		4528·0			6sc	10	22078*bd*
			‡4525·7				4	22090*d*
			‖4524·4				8	22096*d*
			4522·6				2	22105*d*
			4522·0				2	22108*d*
			4519·5				2	22120*d*
			4517·6				1	22129*d*
			4516·8				4	22133*d*
			4514·7				1	22143*d*
			4513·4				4	22150*d*
			4508·9				1b	22172*d*
			4507·6				1	22178*d*
			4506·5				1	22184*d*
			4504·2				3	22195*d*
			4501·8				2	22207*d*
			4498·4				2n	22224*d*
			4496·2				2n	22235*d*
			*4493·8				10	22246*d*
			4492·0				1	22255*d*
			4490·2				2	22264*d*
			4489·3				4	22269*d*
			4488·8				5	22271*d*
			4488·3				2	22274*d*
			4487·5				2	22278*d*
			4484·8				4	22291*d*
			4483·5				3	22298*d*
			4482·0				1	22305*d*
			*4481·6				10	22307*d*

* also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† here is double, the less refrangible ray being due to Calcium.
‡ 4534·3, 4534·9, 4534·1, 4532·0, 4520·3. ‖ Barium: 4553·4, 4524·4.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4682·7				4	21349*d*
			4681·3				2	21355*d*
			4680·6				1	21358*d*
			4679·7				2	21362*d*
			4677·9				10	21371*d*
			4672·2				6b	21397*d*
			4668·3				5	21415*d*
			4667·2				10	21420*d*
			4665 5				10	21427*d*
			4664·9				2	21430*d*
			4662·3				1	21442*d*
			4661·2				2b^{r}	21447*d*
			4660·7				1	21450*d*
			4657·5				1	21464*d*
			4656·7				1	21468*d*
	4653·5		4653·7			6sc	10	21482*bd*
			4650·4				1	21497*d*
			4649·2				1	21503*d*
			4646·7				8	21514*d*
			4642·7				6	21533*d*
			4640·0				1n	21545*d*
			4637·3				8	21558*d*
			4636·7				8	21561*d*
			4635·0				4	21568*d*
			4633·9				2	21574*d*
			4633·0				1	21578*d*
	4632·1		4632·1			6sc	6	21582*bd*
			4629·3				6	21595*d*
			4626·6				1	21608*d*
			‡4624·3				8	21618*d*
			4618·6				8	21645*d*
			‡4618·1				2	21647*d*
			4614·8				1	21663*d*
			4613·3				1	21670*d*
			4612·5				6	21672*d*
	4610·7		4610·5			6sc	8	21682*bd*
			‡4607·0				6	21701*d*
			4603·7				2	21715*d*
	4602·7		4602·3			4sd	10	21721*bd*
			4601·3				4	21726*d*
			†4600·2				1	21732*d*
			4597·4				5	21745*d*
			4595·3				4	21755*d*
			4594·7				4	21758*d*
	4592·0		4591·9			6sc	8	21770*bd*
			4590·1				1	21779*d*
4582			‡4586·4			1s	4	21796*d*
			*4584·2				4	21807*d*
			4583·3				2	21812*d*
			‡4580·8				6	21824*d*
			4579 8				2	21828*d*
			‡4579·4				1	21830*d*

* The solar ray here is double, the less refrangible ray being due to Calcium.

† Barium : 4599·1

‡ Calcium : 4622·4, 4616·6, 4606·7, 4585·3, 4580·8, 4578·0.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4574·2				4	21855*d*
			4572·2				1	21865*d*
			4571·1				1	21870*d*
			4568·2				4	21884*d*
			4566·3				2	21893*d*
			4565·8				1	21895*d*
			4565·0				2	21899*d*
			4564·2				2	21903*d*
			4560·7				1	21920*d*
			4559·4				2n	21926*d*
			4557·3				1	21936*d*
			‖4555·4				8	21945*d*
			4551·8				4	21963*d*
			4550·1				2	21971*d*
			4548·9				5	21977*d*
			4547·3				8	21984*d*
			4546·3				1	21989*d*
			4544·0				1	22000*d*
			4541·8				2n	22011*d*
			4538·0				2	22029*d*
			††‡4532·5				2	22056*d*
			4530·8				1	22065*d*
			4530·4				6	22067*d*
			4528·8				2	22075*d*
	4528·1		4528·0			6sc	10	22078*bd*
			‡4525·7				4	22090*d*
			‖4524·4				8	22096*d*
			4522·6				2	22105*d*
			4522·0				2	22108*d*
			4519·5				2	22120*d*
			4517·6				1	22129*d*
			4516·8				4	22133*d*
			4514·7				1	22143*d*
			4513·4				4	22150*d*
			4508·9				1b	22172*d*
			4507·6				1	22178*d*
			4506·5				1	22184*d*
			4504·2				3	22195*d*
			4501·8				2	22207*d*
			4498·4				2n	22224*d*
			4496·2				2n	22235*d*
			*4493·8				10	22246*d*
			4492·0				1	22255*d*
			4490·2				2	22264*d*
			4489·3				4	22269*d*
			4488·8				5	22271*d*
			4488·3				2	22274*d*
			4487·5				2	22278*d*
			4484·8				4	22291*d*
			4483·5				3	22298*d*
			4482·0				1	22305*d*
			*4481·6				10	22307*d*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† The solar ray here is double, *the less* refrangible ray being due to Calcium.
‡ Calcium: *4535·3, 4534·2, 4534·1, 4532·0,* 4520·3. ‖ Barium: 4553·4, 4524·4.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4682·7				4	213
			4681·3				2	213
			4680·6				1	213
			4679·7				2	213
			4677·9				10	213
			4672·2				6b	213
			4668·3				5	214
			4667·2				10	214
			4665 5				10	214
			4664·9				2	214
			4662·3				1	214
			4661·2				2b[r]	214
			4660·7				1	214
			4657·5				1	214
			4656·7				1	214
	4653·5		4653·7			6sc	10	214
			4650·4				1	214
			4649·2				1	215
			4646·7				8	215
			4642·7				6	215
			4640·0				1n	215
			4637·3				8	216
			4636·7				8	215
			4635·0				4	215
			4633·9				2	215
			4633·0				1	215
	4632·1		4632·1			6sc	6	215
			4629·3				6	215
			4626·6				1	216
			‡4624·3				8	216
			4618·6				8	216
			‡4618·1				2	216
			4614·8				1	216
			4613·3				1	216
			4612·5				6	216
	4610·7		4610·5			6sc	8	216
			‡4607·0				6	217
			4603·7				2	217
	4602·7		4602·3			4sd	10	217
			4601·3				4	217
			†4600·2				1	217
			4597·4				5	217
			4595·3				4	217
			4594·7				4	217
	4592·0		4591·9			6sc	8	217
			4590·1				1	217
4582			‡4586·4			1s	4	217
			*4584·2				4	218
			4583·3				2	218
			‡4580·8				6	218
			4579 8				2	218
			‡4579·4				1	218

* The solar ray here is double, the less refrangible ray being due to Calcium. † Barium : 4
‡ Calcium : 4622·4, 4616·6, 4606·7, 4585·3, 4580·8, 4578·0.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4574·2				4	21855*d*
			4572·2				1	21865*d*
			4571·1				1	21870*d*
			4568·2				4	21884*d*
			4566·3				2	21893*d*
			4565·8				1	21895*d*
			4565·0				2	21899*d*
			4564·2				2	21903*d*
			4560·7				1	21920*d*
			4559·4				2n	21926*d*
			4557·3				1	21936*d*
			‖4555·4				8	21945*d*
			4551·8				4	21963*d*
			4550·1				2	21971*d*
			4548·9				5	21977*d*
			4547·3				8	21984*d*
			4546·3				1	21989*d*
			4544·0				1	22000*d*
			4541·8				2n	22011*d*
			4538·0				2	22029*d*
			††‡4532·5				2	22056*d*
			4530·8				1	22065*d*
			4530·4				6	22067*d*
			4528·8				2	22075*d*
	4528·1		4528·0			6sc	10	22078*bd*
			‡4525·7				4	22090*d*
			‖4524·4				8	22096*d*
			4522·6				2	22105*d*
			4522·0				2	22108*d*
			4519·5				2	22120*d*
			4517·6				1	22129*d*
			4516·8				4	22133*d*
			4514·7				1	22143*d*
			4513·4				4	22150*d*
			4508·9				1b	22172*d*
			4507·6				1	22178*d*
			4506·5				1	22184*d*
			4504·2				3	22195*d*
			4501·8				2	22207*d*
			4498·4				2n	22224*d*
			4496·2				2n	22235*d*
			*4493·8				10	22246*d*
			4492·0				1	22255*d*
			4490·2				2	22264*d*
			4489·3				4	22269*d*
			4488·8				5	22271*d*
			4488·3				2	22274*d*
			4487·5				2	22278*d*
			4484·8				4	22291*d*
			4483·5				3	22298*d*
			4482·0				1	22305*d*
			*4481·6				10	22307*d*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† The solar ray here is double, the less refrangible ray being due to Calcium.
‡ Calcium: 4535·3, 4534·9, 4534·1, 4532·0, 4529·3. Barium: 4553·4, 4524·4.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4481·0				1	22310*d*
			4479·4				3	22318*d*
			4478·8				3	22321*d*
			4475·4				10	22338*d*
			4468·7				8	22370*d*
			4466·0				8	22385*d*
			4461·2				8	22409*d*
			*4458·6				3	22422*d*
			†4455·7				3	22437*d*
			4453·8				6	22444*d*
			4452·8				1	22451*d*
			4449·8				3	22466*d*
			*4447·2				10	22479*d*
			4446·3				2n	22484*d*
			4445·0				1	22491*d*
			4442·7				8	22502*d*
			4441·7				10	22507*d*
			4440·3				1 } *b*	22514*d*
			4439·9				1 }	22516*d*
			4439·3				2	22519*d*
			4437·8				2	22527*d*
			4436·3				2	22535*d*
			4433·2				4	22550*d*
			4432·6				6	22553*d*
			4432·0				4	22557*d*
			4430·2				6	22566*d*
			4429·6				2	22569*d*
			4426·7				8	22584*d*
			4423·3				1n	22601*d*
			4422·5				1	22605*d*
			4421·8				8	22609*d*
	*4414·8	4414·6	‖4414·3		(4414·8)	10sc	10r	22645*bcd*
			4407·8		4407·7		6	22680*df*
		Hartley and Adeney	4407·2				6	22683*d*
4406	*4404·3	‡4403·7	4404·3		(4404·3)	8sc	10r	22699*bcd*
			4400·7				6	22717*d*
			4394·5				2d	22749*d*
			4392·2				1b	22759*d*
			4390·5				4	22770*d*
			4330·2				1	22771*d*
			4388·8				2	22779*d*
			4387·9				5	22783*d*
			4387·4				4	22786*d*
			4384·9				1	22799*d*
			4384·3				1	22801*d*
4380	*4382·9	§4382·6	4383·0		(4382·9)	8sc	12r	22810*bcd*
			4376·9		4379·1		1	22829*df*
			4376·4				1	22843
			4375·6				6	22847*d*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† See Calcium. ‡ (4404·3)—Kirchhoff. § (4382·9)—Kirchhoff; see Calcium.
‖ Less refrangible than the Manganese line 4414·2.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Hartley and Adeney *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4374·2				1	22854*d*
			4373·3				3	22859*d*
			4372 4				1	22864*d*
			4369·3				6	22880*d*
			4367·6				2	22889*d*
			4367·2				6	22891*d*
			4365·5				2	22900*d*
			4362·5				1b	22916*d*
			4360·5				2	22926*d*
			4358·1				6	22939*d*
			4352·3				8	22969*d*
			4351·0				4	22982*d*
			4348·6				2	22989*d*
			4347·4				2	22995*d*
			4346·2				4	23002*d*
			4344·2				1	23012*d*
	4343·1		4343·3				2	23018*bd*
			4342·7				2	23020*d*
			4340·0				1b	23035*d*
		4338·0	4337·8			4sd	3	23046*d*
			4336·6				10	23053*d*
			4332·0				1	23077*d*
			4330·6				2	23085*d*
			4327·3				2	23102*d*
			4326·6				4	23106*d*
			4326·3				1	23107*d*
4324	*4325·2	†4325·0	§4325·3		(4325·2)	8sc	10r	23114*bcd*
			‖4321·4				4	23134*d*
			4320·2				1b	23140*d*
	4314·6		4314·6		(4314·6)	6sd	10r	23170*bd*
			4310·0				1	23195*d*
			4309·2				4	23199*d*
G 4307	*4307·2	‡4307·1	4307·3		(4307·2)	8sc	10r	23210*bcd*
4303			4304·7			3s	5	23223*d*
			4304·0				2	23227*d*
			4301·7				4	23240*d*
4300	4298·5	4298·3	4298·8			3s	10	23257*bcd*
			4297·6				4	23262*d*
4294	4293·9	4293·3	4293·7			3sd	8	23283*bcd*
			4291·7				2	23294*d*
			4291·2				3	23296*d*
			4290·5				1	23300*d*
			4289·9				2	23304*d*
			4288·7				1	23310*d*
			4287·7				2	23315*d*
			4286·7				2	23321*d*
	4286·0		4286·2			4sd	1	23324*bd*
			4285·2				4	23329*d*
		4281·7	4282·1			2sd	8	23347*cd*
			4280·0				1	23357*d*
			4279·4				2	23361*d*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† 4325·6—Kirchhoff. ‡ 4306·9—Kirchhoff. § Possibly not due to Iron.
‖ Calcium : 4318·2, 4307·2, 4305·4, 4302·1, 4298·5, 4289·0, 4282·7.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins	Thalén *b*	Hartley and Adeney *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4279·2				1	23362*d*
			4277·9				2	23369*d*
			4277·3				1n	23372*d*
			4276·4				2	23377*d*
			4275·3				1	23381*d*
			4273·7				2	23392*d*
4272	*4271·3	4271·0	4271·6		(4271·6)	8sc	10	23403*d*
			4271·0		(4270·9)		10	23406*d*
			4268·6				3	23420*d*
			4267·6				5	23425*d*
			4266·7				3	23430*d*
			4265·2				1	23438*d*
			4264 1				1	23445*d*
4259	*4260·0	4259·9	4260·2			7sc	10	23467*bcd*
			4258·4				1	23476*d*
			4258·0				2	23478*d*
			4255·3				1d	23493*d*
			4254·6				1d	23497*d*
			4253·6				1	23502*d*
	*4250·5		4250·5			10sc	10	23519*bd*
	4249·8	4249·8	4249·8			8sc	10	23523*bcd*
			4247·9				3	23534*d*
	·5 4247		4247·1			4sd	8n	23538*bd*
			4245·7				3	23546*d*
			4244·9				6	23550*d*
			4243·4				1	23559*d*
			4243·0				1	23561*d*
			4242·3				3	23565*d*
			4240·7				1	23574*d*
			‡4239·4				4	23581*d*
			4238·5				6	23586*d*
			4237·7				4	23590*d*
			4236·8				2	23595*d*
	*4235·5		4235·6			6sd	8	23602*bd*
	4233·0		4233·3			6sd	8	23619*bd*
			4229·0				2	23639*d*
	†*4226·8		4227·0			2sd	10	23650*bd*
			4225·9				1	23656*d*
			4225·5				2	23659*d*
			4225·0				4	23661*d*
			4224·1				1	23666*d*
			4223·7				4	23669*d*
	4221·7		4221·8			2sd	6	23680*bd*
			4219·8				3	23690*d*
	4218·3		4218·8			2sd	6	23701*bd*
			4217·2				5	23705*d*
			‡4215·7				6	23714*d*
			4213·2				4	23728*d*
	4209·9		4209·8			2sd	8	23747*bd*
			4208·2				5	23756*d*
			4206·7				4	23764*d*
			4206·3				3	23767*d*

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Ferric Chloride solution.
† See Calcium. ‡ Possibly due to Manganese.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Hartley and Adeney *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4205·0				2	23774*d*
			4203·5				5	23782*d*
4201	*4201·5	4201·4	†4201·6			5sc	10	23794*bcd*
			4200·3				2	23800*d*
4199	*4198·0	4198·4	4198·7			3sc	10	23814*bcd*
			4197 7			10sc	10	
			4195·7				4	23827*d*
			4195·3				5	23829*d*
	4191·2		4190·9			8sc	10	23853*bd*
	4187·2		4187·3			10sc	10	23875*bd*
	4186·7		4186·6			10sc	10	23878*bd*
			4184·4				6	23891*d*
	4181·3		4181·8				3	23907*bd*
			4181·3				8	23909*d*
	4177·0		4177·2				4	23933*bd*
			4176·0				4n	23940*d*
			4175·2				6	23944*d*
			4174·3				4	23949*d*
			4173·4				1	23954*d*
			4172·8				2	23958*d*
			4172·2				3	23961*d*
			4171·5				4	23965*d*
			4170·4				4	23972*d*
			4168·4				1b	23983
			4167·3				2	23989*d*
			4164·8				1b	24004
			4163·0				1b	24014*d*
			4160·9				1	24026
			4158·2				4	24042*d*
			4157·2				6	24048*d*
			4156·2				6	24054*d*
			4154·2				4	24065*d*
	*4153·8		4153·8				6	24067*bd*
			4153·2			6sd	6	24071*d*
4151	4151·5		4151·4			4sd	2n	24080*bd*
			4149·7				1	24091*d*
	4148·6		4148·6			4sd	2	24098*bd*
			4147·0				4	24107*d*
			4145·4				1	24116*d*
4142	*4143·1	4143·0	4143·2			6sc	10	24130*bcd*
			4142·7				10	24132*d*
			4142·2				1	24141*d*
			4139·2				1b	24152*d*
			4136·3				6	24169*d*
	*4133·9		4134·0			8sc	6	24183*bd*
			4133·2				1	24187*d*
			4132·2				4	24193*d*
4131	4131·5		4131·3			10sc	10	24198*bd*
			4126·9				6	24224*d*
			4125·5				4br	24233*d*
			4123·2				2	24246*d*
			4121·8				2	24254*d*

* Observed also in the Spark Spectrum of Ferric Chloride solution by Lecoq de Boisbaudran, who gives also lines at 6095, 6045, 5980, 5936, 5865, and 5829.

† Possibly due to Manganese.

IRON—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensityand Character		Osc. Freq.
Huggins *a*	Thalén *b*	Hartley and Adeney *c*	Vogel and Thalén *d*	Cornu *e*	Liveing and Dewar *f*	I.	II.	
			4121·1				4	24258*d*
			4119·5				4	24268*d*
	4117·8		4117·8			8sc	8	24278*d*
			4113·7				4	24302*d*
			4112·3				3	24310*d*
			4109·2				6	24327*d*
			4106·8				6	24343*d*
			4105·7				1	24349*d*
			4103·5				3	24362*d*
			4100·2				4	24382*d*
			4097·6				5	24397*d*
			4095·6				5	24409*d*
			4086·5				2	24464*d*
			4084·7				4	24474*bd*
			4084·4				4	24476*d*
			4083·9				6	24479*d*
			4079·7				2	24504*d*
			4079·3				2	24507*d*
			4077·8				2	24516*d*
			4076·0				6	24527*d*
			4074·2				3	24536*d*
			4073·1				3	24544*d*
4074	*4071·0	4071·5	4071·0	4071·1	(4071·0)	8sc	10r	24556*bode*
			4069·7				2	24565*d*
			4067·3				4	24579*d*
			4066·7				2	24583*d*
			4066·3				2	24585*d*
4067	*4062·9	4063·0	4063·0	4062·9	(4062·9)	8sc	10r	24606*bode*
			4061·8				4	24612*d*
			4059·2				1	24628*d*
			4058·2				1	24634*d*
			4057·6				2	24638*d*
			4056·7				1	24643*d*
			4054·2				4	24658*d*
			4051·7				2b	24674*d*
			4048·2				1	24695*d*
4047	*4045·0	4045·4	4045·3	4045·0	(4045·0)	8sc	10r	24713*bode*
			4044·0				4	24721*d*
			4043·3				4	24725*d*
			4040·5				2	24742*d*
			4039·5				2	24748*d*
			4033·9				4	24783*d*
			4032·4				4	24792*d*
			4032·0				2	24794*d*
			4031·3				1	24798*d*
			4030·0				6	24807*d*
			4024·0				4	24843*d*
			4021·3				4	24860*d*
			4017·5				1	24884*d*
			4016·4				5	24890*d*
			4013·8				4	24907*d*
			4013·0				1	24912*d*

* Observed also in the Spark Spectrum of Ferric Chloride solution by Lecoq de Boisbaudran, who gives *also lines at 6095, 6045, 5980, 5936, 5865,* and 5829.

IRON.—*continued.*

I. Spark Spectrum			II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Hartley and Adeney *c*	Thalén and Vogel *d*	Cornu *e*	Lockyer *f*	I.	II.	
			4009·0				4	24936*d*
			4006·6				1	24951*d*
			4005·5				1	24958*d*
	4004·8	4005·0	4004·3	4004·3		4sc	6	24964*bcde*
			4000·9				2	24987*d*
			3999·5				1	24996*d*
			3997·2	3996·7	3997·5		4	25011*def*
			3996·7		3996·9		4	25012*df*
					3996·5			25014*f*
					3995·2			25023*f*
					3993·5			25033*f*
					3984·6			25089*f*
					3983·2			25098*f*
					3980·8			25113*f*
					3976·8			25138*f*
					3975·8			25146*f*
					3975·5			25146*f*
					3970·3			25179*f*
					3969·5			25184*f*
					3968·6			25190*f*
					3968·3			25192*f*
H_1		*3968·7	3968·1	3966·7	3967·0	5sc		25197*cdef*
					3965·5			25210*f*
					3965·1			25212*f*
					3964·5			25216*f*
					3963·6			25222*f*
					3962·1			25232*f*
					3959·2			25250*f*
				3955·9	3955·7			25272*f*
					3955·5			25273*f*
					3954·2			25282*f*
					3952·1			25295*f*
			3951·4		3951·6			25299*d*
					3950·1			25308*f*
					3948·8			25316*f*
					3947·8			25323*f*
					3947·2			25327*f*
					3946·7			25330*f*
					3946·0			25334*f*
					3944·2			25346*f*
					3943·8			25349*f*
					3942·5			25357*f*
				3941·8	3941·5			25363*ef*
					3940·3			25371*f*
					3939·7			25375*f*
					3936·3			25397*f*
					3934·7			25407*f*
					3934·3			25410*f*
H_2		*3933·1	3933·0	3932·9	3931·7	3sd		25418*cde*
					3930·2			25436*f*
		3929·7		3929·8	3929·5	3sc		25439*cef*
		3927·6		3927·3	3927·0	3sc		25455*cef*

* See Calcium.

IRON—*continued.*

I. Spark Spectrum		II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Hartley and Adeney *c*	Thalén and Vogel *d*	Cornu *e*	Lockyer *f*	I.	II.	
				3925·3			25468*f*
				3924·9			25471*f*
	3922·5		3922·0	3922·0	3sc		25487*cef*
			3920·0	3919·4			25504*ef*
			3918·4	3918·3			25513*ef*
			3917·8	3917·7			25517*ef*
				3917·5			25519*f*
				3916·5			25525*f*
				3916·0			25531*f*
				3912·9			25549*f*
				3910·2			25572*f*
				3907·3			25585*f*
				3906·2			25592*f*
			3905·9	3906·0			25594*ef*
				3903·3			25611*f*
				Liveing and Dewar			
	3902·6		3901·9		3sc		25618*ce*
	3899·3		3898·4	(3898·4)	3sc		25641*ce*
			3897·0				25653*e*
	3895·1		3894·7		3sc		25667*ce*
			3892·6				25682*e*
	3888·1		3888·0		3sc		25712*ce*
			3887·4				25716*e*
			3886·4				25723*e*
	3885·7		3886·0	(3886·0)	7sc	r	25727*ce*
			3884·7				25734*e*
			3880·3				25763*e*
	3878·1		3877·4		7sc		25780*ce*
	3872·2		3871·3		3sc		25820*ce*
			3870·6				25828*e*
	3865·2		3865·5		3sc		25863*ce*
			3865·2				25864*e*
			3864·8				25867*e*
			3860·6				25895*e*
	3859·6		3859·3		7sc	r	25903*ce*
	3856·1		3855·7		7sc	r	25926*ce*
			3853·7				25941*e*
			3852·7				25948*e*
			3851·8				25954*e*
			3850·0				25966*e*
	3849·1		3849·7		3sc		25970*ce*
			3845·9				25994*e*
			3844·6				26002*e*
			3841·9				26021*e*
	3840·3		3840·5		7sc		26030*b*
			3840·1				26033*b*
			3838·5				26044*b*
	3834·0		3833·6		7sc	r	26076*ab*
	3827·4		3827·7		7sc	r	26119*ab*
	3825·5		3825·3		7sc	r	26131*ab*
	3824·0		3824·1		5sc	r	26142*ab*

IRON—*continued*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Hartley and Adeney *a*	Cornu *b*	I.	II.		Hartley and Adeney *a*	Cornu *b*	I.	II.	
						3685·0			27129*b*
L 3820·3	*3819·7	7sc	r	26170*ab*	3683·0	3683·9	3nc		27141*ab*
	3819·2			26176*b*		3681·7			27153*b*
	3816·9			26192*b*	3679·5	3680·3	5sc		27167*ab*
3815 8	3815·3		r	26201*ab*	3676·5	3677·6	3nc		27196*ab*
	3814·0			26212*b*		3669·3	3sc		27245*b*
3812·6	3812·6	2sc		26221*ab*		3662·4	1sd		27296*b*
3804·4	3805·0	3nc		26275*ab*		3662·0	2sd		27299*b*
	3802·0			26294*b*		3656·2	2sd		27343*b*
	3799·4			26312*b*		3651·7	3nc		27376*b*
3798·4	3798·7	3sc		26319*ab*		3649·4	3nc		27393*ab*
	3796·8			26330*b*	3649·6	3648·6	7sc	r	27399*b*
3794·6	3794·9	3sc		26345*ab*	3647·6	3646·9			27409*ab*
	3793·3			26355*b*	3640·0		3sc		27464*a*
	3792·7			26359*b*	3637·8	3637·7	3sc		27482*ab*
	3792·2			26362*b*		3633·8			27511*b*
	3790·5			26374*b*	3631·0	3630·9	7sc	r	27533*ab*
	3789·8			26379*b*		3623·7			27588*b*
3788·0	3787·1			26394*ab*		3622·7			27595*b*
	3786·2			26404*b*		3621·0			27608*b*
	3785·4			26410*b*	3620·3	3620·6	3sc		27613*ab*
3767·0	3766·8	7sc	r	26413*ab*	3618·6	3617·8	7sc		27630*ab*
3765·3	3765·0	2sc		26552*ab*		3616·9			27640*b*
3763·3	3763·4	7sc		26564*ab*	3609·2	3609·7	7sc		27697*ab*
3757·9	3757·7	7sc	r	26604*ab*		3608·3			27705*b*
	3753·4			26634*b*	3605·6	3606·0	3nc		27717*ab*
3749·4	3749·5	9sc		26662*ab*		3604·6			27734*b*
	3748·2			26672*b*	3602·4	3602·1	3nd		27752*ab*
3745·4	3745·5		r	26691*ab*	3598·4	3601·8	1sd		27765*ab*
3742·7	3742·9			26710*ab*	3594·9	3594·0	3nc		27813*ab*
3736·9	3736·5		r	26754*ab*	3588·2				27861*a*
3734·7	3734·4		r	26769*ab*	3586·3	3586·2	2sc		27876*ab*
	3733·2			26779*b*	3584·8	3584·9	3nc		27886*ab*
	3732·4			26785*b*		3584·1	3nc		27892*b*
M 3727·0	†3727·0	sc	r	26823*ab*	N 3581·1	‡3580·6	9sc		27918*ab*
	3726·7			26825*b*	3569·6	3568·9	9sc		28009*ab*
	3724·1			26844*b*	3565·0	3564·1	9sc		28046*ab*
3722·0	3721·9	4sc	r	26860*ab*	3558·1	3558·1	5nc		28096*ab*
3719·7	3719·7	7sc	r	26876*ab*		3556·0			28113*b*
	3716·4			26900*b*	3554·2	3554·0	5nc		28128*ab*
	3715·5			26906*b*	3540·9	3541·5	5nc		28230*ab*
3709·0	3709·0	5sc		26953*ab*		3540·1			28239*b*
	3707·8		r	26962*b*		3539·2			28246*b*
	3707·5			26964*b*	3534·8	3535·4	3nc		28279*ab*
3705·5	3705·5	5sc	r	26977*ab*	3531·2		3nc		28310*a*
	3703·7			26992*b*	3528·2	3527·0	1sc		28339*ab*
	3703·2			26998*b*	3525·9	3525·7	5sc		28354*ab*
3700 0	3700·8	2sc		27012*ab*	3520·7	3520·6	5sc		28395*ab*
3694·2	3693·7	2sc		27064*ab*	3513·3	3513·7	5sc		28453*ab*
3688·5		2nd		27103*a*		3505·8			28515*b*
3687·3	3687·2	5sd		27112*ab*		3501·8		r	28548*b*
	3685·8			27123*b*					

* 3819·0—Mascart. † 3728·8—Mascart. ‡ 3580·2—Mascart.

IRON—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Liveing and Dewar	Liveing and Dewar	I.	II.		Liveing and Dewar	Liveing and Dewar	I.	II.	
	2517·4		2	39711	2481·8	2481·8	6	1r	40280
2516·8	2516·8	6	1	39720	2481·3		1		40288
	2516·3		1	39728	2480·7		1		40298
*2515·8	*2515·8	1	10	39736	2480·0	2480·0	8	1r	40310
2514·7		4		39754	2479·5	2479·5	1	8	40318
	2514·3		1	39760		2479·2		1	40323
*2514·1	*2514·1	6	6	39763	2479·0		1		40326
	2513·2		1	39777	†2478·3	†2478·3	6	10	40337
2512·2	2512·2	4	6	39793	2477·9		1		40344
	2512·0		6	39796	2477·1		2		40357
	2511·6		1	39803	2476·5	2476·5	1	2	40367
†2511·4	†2511·4	10	1	39806	2476·0		1		40375
2510·6	2510·6	2	8r	39819		2475·8		1	40378
†2508·8		2		39841	2475·5		1		40383
	†2508·5		2	39852	2474·9		1		40393
2507·9		1		39861	2474·5	2474·5	6	6r	40399
2507·6	2507·6	1	6	39864	2472·9		2		40425
*2506·6	*2506·6			39882		2472·7		1	40430
	2506·2		1	39888	2472·4	2472·4	2	8	40433
2505·8		6		39895	2471·9	2471·9	4	6	40442
	2505·2		1	39904		2470·5		1	40465
2504·9	2504·9	1	1	39907	2470·3		8		40468
2503·6		6		39930	2469·0		6		40489
2503·1		6		39938	2468·4	2468·4	1	6	40499
	2503·0		1	39939	2467·8		2		40510
2502·1	2502·1	8	1r	39954		2467·2		2	40519
	2501·4		2	39965	2466·4	2466·4	8	2	40532
2500·9	2500·9	1	8	39973	2465·4		6		40548
2500·7		4		39976	2464·7	2464·7	4	6r	40560
2498·7	2498·7	10	1	40008	2464·5		4		40563
2497·5	2497·5	8	1	40027	2463·7		4		40576
2496·3	2496·3	1	6	40046		2463·4		2	40581
2495·6	2495·6	4	2	40058	2462·8	2462·8	4	1	40591
	2493·9		1	40085	2462·3	2462·3	4	1	40599
2493·7	2493·7	2	2	40088		2461·9		6	40606
2492·9	2492·9	10	6	40099	2461·4		6		40614
2492·0	2492·0	1	1	40116	2461·0	2461·0	6	1	40621
2491·1		6		40130		2460·8		1	40624
	2491·0		8r	40132	2460·2	2460·2	4	1	40634
2490·5	2490·5	8	10r	40140	2458·5	2458·5	10	1	40662
2489·5	2489·5	8	10r	40156		2458·2		1	40667
2489·2		4		40161	2457·4	2457·4	2	8	40680
	2488·7		1	40169	2456·4		1		40697
2487·7	2487·7	6	10	40185		2456·0		1	40703
	2487·1		2	40195	2455·7		1		40712
	2486·8		2	40199		2455·3		1	40715
	2486·4		2	40206	2454·3		6		40732
2486·1	2486·1	8	2	40211	2453·8		1		40741
	2485·7		1r	40217	2453·5		2		40745
	2484·7		1r	40233		2453·2		6	40750
2483·7	2483·7	6	6	40250	2452·9		1		40755
2483·3		1		40256		2452·3		1	40765
2482·9	2482·9	1	10	40262		2451·8		1	40773
2482·4		6		40271		2451·3		1	40781

* Probably due to Silicon.

† Probably due to Carbon.

IRON—*continued.*

I. Spark Spectrum		II. Arc Spectrum		Intensity and Character		Osc. Freq.
	Hartley and Adeney *a*		Cornu *b*	I.	II.	
	3132·9			1sd		31909*a*
	3132·1			1sd		31917*a*
	3126·0			2sc		31980*a*
	3120·7			1nd		32034*a*
	3116·1			3sd		32081*a*
	3113·4			3sd		32109*a*
	3104·8			2sd		32198*a*
	3104·3			3sd		32203*a*
		3099·8	7sc			32250*a*
S_2	3099·5	3099·5		r		32253*ab*
		3099·2				32256*a*
	3096·7			3sd		32282*a*
	3090·7	3090·4		3sd		32347*ab*
	3089·3			2sd		32360*a*
	3082·8	3082*		3sc	r	32429*a*
	3078·6	3079·3		5sd	r	32469*ab*
	3076·7			7sd		32493*a*
	3075·5			5sc		32503*a*
	3070·3	3072*		2nd	r	32560*a*
	3066·6	3065·5		5sc		32606*ab*
	3064·3			2sd		32625*a*
	3061·3			5sd		32656*a*
	3058·5	3057·3		5sc		32686*a*
	3056·3			5sc	r	32709*a*
		3056*			r	32713*b*
	3054·8			1sd		32726*a*
	3052·1			1sd		32755*a*
	3048·6			1sd		32792*a*
s	3046·9	3046·5		5sc	r	32813*ab*
	3044·2			2sd		32840*a*
	3041·5	3041·5		2nc	r	32869*ab*
	3040·8	3040·7		2nc		32876*ab*
	3040·0	3040·3		2nc		32884*ab*
		3039·2				32894*b*
	3036·4	3036·2		5sc	r	32925*ab*
	3032·8			1sd		32963*a*
	3030·0	3029·8		3sc	r	32995*ab*
	3028·8	3028·7		3sc		33007*ab*
	3024·8	3025·3		5sc		33045*b*
		3024·6			r	33052*b*
	3022·5	3022·7		3sc	r	33074*ab*
T	3020·1	3019·9		7sc	r	33103*ab*
	3018·1	3019·4		2sc	r	33117*ab*
		3017·7			r	33128*b*
	3016·9	3016·5		2sc	r	33139*ab*
	3015·2	3015·0		2sc		33157*ab*
	3012·4			3sd		33186*a*
	3010·9			2sd		33203*a*
		3008·4			r	33230*b*
	3007·9	3007·3		3sc	r	33239*ab*
	3006·8			3sc		33248*a*
	3006·2	3006·3		3nd	r	33255*ab*

I. Spark Spectrum		II. Arc Spectrum	Intensity and Character		Osc. Freq.
	Hartley and Adeney *a*	Cornu *b*	I.	II.	
	3005·7		3sc		33260*a*
	3002·1	3002·7			33293*b*
		3002·4	7sc		33297*b*
	2999·6	3000·2	5sc	r	33324*ab*
	2998·1	2999·0	5sc	r	33340*ab*
	2996·3		3sd		33364*a*
t	2993·7	2994·4	5sc	r	33389*ab*
	2989·8		1sd		33437*a*
	2986·2	2987·1	1sc		33473*ab*
	2984·6		7sc		33495*a*
	2984·0	2984·1	7sc	r	33501*ab*
	§2982·8	2982·0	3sc	2r	33520*ab*
	2980·8		3sd		33538*a*
	2979·8	2979·7	3sc		33549*ab*
	2977·8	2976·8	3sd		33577*ab*
	2974·8	2973·8	2nd	r	33611*ab*
	2972·1	2970·7	5sc	r	33644*ab*
	2969·4	2970·0	5nc		3366 *ab*
		2967·4		r	33689*b*
	2966·0	2965·6	5sc	r	33707*ab*
	2964·3		3sc		33725*a*
	2963·2		3nd		33737*a*
	2960·2	2960·5	1sd		33770*ab*
	2959·0		5sc		33785*a*
		2957·4		r	33803*b*
	2956·5		3sc		33814*a*
	2952·9	2953·8	7sc	r	33850*ab*
		2950·5	5sd		33882*b*
	2948·4	2947·8†	7sc	r	33910*ab*
U	2946·9				33924*a*
	Liveing and Dewar	Liveing and Dewar			
		2944·6		1	33950*b*
	2944·0	2944·0	8	1	33957*ab*
		2943·1		1r	33967*b*
		2940·8		8	33994*b*
		2939·9		1	34004*b*
	2938·7	2938·7	1	4r	34018*ab*
		2937·3		2	34034*b*
	2936·4	2936·4	2	10r	34045*ab*
	2932·4	2932·4	1	2	34091*ab*
	2931·1		1		34106*a*
	2928·3	2928·3	4	10r	34139*ab*
	2926·0	2926·0	8	1	34166*ab*
		2925·2		1	34175*b*
		2924·7		1	34181*b*
		2923·2		1	34200*b*
	2922·8	2922·8	1	1	34203*ab*
	2921·5		1		34219*a*
		2920·0		1	34236*b*
	2917·4	2917·4	1	2	34267*ab*

* Liveing and Dewar. † 2947·3—Liveing and Dewar. § 2982·0—Cornu. † Probably due to Carbon.

IRON—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Liveing and Dewar	Liveing and Dewar	I.	II.		Liveing and Dewar	Liveing and Dewar	I.	II.	
2374·9	2374·9	10	8	42093		2334·5		1	42823
	2374·1		1	42107		2334·2	1		42829
2373·4	2373·4	10	8	42120		2333·1		1	42849
2373·3		4		42121	2332·5	2332·5	10	8	42860
	2372·7		1	42132	2330·9	2330·9	10	8	42889
2372·3		4		42139		2329·3		1	42919
	2371·1		4	42160	2326·9	2326·9	10	8	42963
2370·1	2370·1	4	4	42178		2319·9		6	43092
2369·6		2		42187		2319·6		1	43098
	2369·1		4	42211		2319·2		2	43105
2368·2	2368·2	10	8	42194		2317·7		1	43133
2366·2	2366·2	6	6	42248		2317·5		2	43138
2365·3		2		42264		2316·7		1	43152
	2365·1		1	42267		2313·6		1	43212
2364·4	2364·4	10	8	42280		2312·7		8	43227
2363·5		6		42296		2312·0		1	43240
2363·3		6		42299		2311·6		1	43249
2362·9		1		42306		2311·0		2	43258
2361·6	2361·6	6	4	42330		2310·6		1	43268
2361·3		1		42337		2309·3		1	43290
	2360·3		1	42355		2308·6		8	43305
2359·9	2359·9	10	8	42362		2306·0		4	43352
2359·7	2359·7	10	8	42366		2305·8		2	43360
2359·2	2359·2	1	1	42375		2304·4		2	43382
2358·7	2358·7	10	10	42384		2303·4		6	43401
2356·7		4		42420		2303·2		6	43405
	2355·6		1	42440		2301·4		6	43439
2355·1	2355·1	2	1	42448		2301·0		4	43446
2354·8		2		42454		2300·4		2	43458
2354·6	2354·6	6	6	42458		2300·0		6	43465
2354·1	2354·1	6	1	42467		2299·2		1	43480
2353·3		2		42481		2299·0		6	43484
2352·1		1		42503		2298·6		4	43492
2351·5	2351·5	1	1	42514		2298·0		6	43503
2350·9	2350·9	8	1	42524		*2297·6		6	43507
2349·9	2349·9	1	1	42542		2296·8		6	43526
	2349·5		1	42550		2294·2		6	43575
2349·0		1		42559		2293·6		6	43586
2348·0	2348·0	10	10	42577		2292·3		6	43611
2347·8	2347·8	10	10	42581		2291·4		1	43628
2346·4		1		42606		2290·9		4	43638
2345·9	2345·9	1	1	42615		2290·6		1	43644
2344·9		6		42633		2290·3		4	43649
	2344·7		4	42637		2289·9		2	43658
2343·9	2343·9	6	4	42651		2288·8		6	43678
2343·6	2343·6	2	1	42657		2287·9		1	43695
2343·1	2343·1	10	10	42666		2287·4		6	43704
2341·8		1		42690		2287·1		6	43710
2341·6		1		42693		2284·0		6	43769
	2341·2		1	42701		2283·6		4	43777
2340·0	2340·0	1	2	42722		2283·2		2	43785
	2339·3		6	42735		2283·0		2	43789
2339·0	2339·0	1	8	42741		2282·8		1	43792
2337·7	2337·7	10	8	42764		2281·8		1	43812
	2534·8		1	42817		2280 0		4	43846

* Probably due to Silicon.

IRON—*continued.*

Arc Spectrum Liveing and Dewar	Intensity and Character	Osc. Freq.	Arc Spectrum Liveing and Dewar	Intensity and Character	Osc. Freq	Arc Spectrum Liveing and Dewar	Intensity and Character	Osc. Freq.
2279·7	6	43850	2262·4	1	44187	2225·2	4	44926
2277·5	4	43892	2260·7	2	44220	2216·2	6	45108
2276·9	4	43906	2260·4	2	44226	2214·1	4	45151
2275·7	4	43929	2259·8	4	44238	2211·4	1	45206
2275·2	1	43939	2259·2	4	44250	2210·4	4	45226
2274·9	4	43956	2255·4	4	44324	2207·5	4	45286
2273·8	4	43966	2252·8	4	44375	2200·2	1	45436
2272·5	4	43991	2251·6	1	44399	2200·0	1	45440
2271·8	4	44004	2251 2	1	44407	2199·3	2	45455
2271·5	4	44010	2250·6	1	44419	2195·5	2	45533
2270·5	4	44030	2250·5	4	44421	2191·3	1	45620
2268·8	1	44063	2248·8	4	44454	2186·8	1	45718
2267·2	6	44094	2248·5	4	44460	2186·1	1	45729
2266·8	2	44101	2245·3	2	44524	2183·7	1	45779
2266·6	1	44106	2243·9	1	44551	2181·5	1	45825
2265·7	1	44127	2242·2	1	44585	2178·0	1	45899
2264·7	2	44145	2240·2	1	44625	2177·0	1	45920
2264·2	2	44152	2230·9	1	44811	2173·4	1	45996
2263·2	1	44172	2229·7	6	44835	2171·7	1	46032
2262·8	1	44179	2227·3	6	44883	2167·4	1	46123

LANTHANUM.

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Spark Spectrum Thalén *a*	Spark Spectrum Kirchhoff *b*	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén *a*	Spark Spectrum Kirchhoff *b*	Intensity and Character	Osc. Freq.
6456·0		4	15485*a*	5973·0		6	16737*a*
6410·0		4	15596*a*	5929·0		8	16861*a*
6392·5		8	15639*a*	5873·0		1	17022*a*
6389·0		2	15647*a*	§5867·0		1	17040*a*
6325·0		2	15806*a*	5862·5	5860·6 La. Di.	4	17052*a*
6318·0		2	15823*a*	5855·0		2	17074*a*
6310·0		2	15843*a*	5851·0		1	17086*a*
6294·0	6293·7 La. Di.	4	15883*a*	5847·5		2	17096*a*
6264·0		2	15960*a*	5828·0		1	17153*a*
6261·5		4	15968*a*	5821·5		1	17173*a*
6249·0		8	15998*a*	5820·0		4	17177*a*
6187·0		2	16158*a*	5807·0	5806·2 La. Di.	1	17216*a*
§6132·0		2	16303*a*	5804·5	5805·1 La. Di.	6	17223*a*
6128·0		2	16314*a*	5794·0	5795·9 La. Di.	6	17254*a*
6124·0		4	16324*a*	5790·5	5790·0 La. Di.	6	17265*a*
6111·0		1	16359*a*	5787·0	5786·1 La. Di.	6	17275*a*
*6107·0		4	16370*a*	5769·0	5767·7 La. Di.	8	17329*a*
6099·0		2	16391*a*	5761·0		4	17353*a*
6006 0		4	16645*a*	5743·0		4	17407*a*

LANTHANUM—*continued.*

Spark Spectrum		Intensity and Character	Osc. Freq.	Spark Spectrum		Intensity and Character	Osc. Freq.
Thalén *a*	Kirchhoff *b*			Thalén *a*	Kirchhoff *b*		
5740·0		4	17416*a*	5113·5	5113·8 La. Di.	6	19550*a*
5734·0		2	17435*a*	5096·5		4	19616*a*
5718·5		2	17451*a*	5066·5		1n	19732*a*
5702·5		1	17531*a*	5061·5		1n	19751*a*
5678·0		6	17622*a*	5055·5		2	19775*a*
5656·5		4	17673*a*	5049·8		2	19797*a*
5646·5		2	17705*a*	4998·5	4999·8 La. Di.	6	20000*a*
†5631·0		6	17747*a*	4990·5	4994·2 La. Di.	2	20032*a*
5602·0		1	17845*a*	4985·5		2	20052*a*
5599·0		1	17855*a*	4969·0	4969·6 La. Di.	4	20119*a*
5587·0		6	17893*a*	4951·5		2	20190*a*
5567·5		4	17956*a*	4949·0		4	20200*a*
5564·5		4	17966*a*	4945·0		1	20216*a*
5549·5		4	18014*a*	4934·0	4933·9 La. Di.	4	20261*a*
5534·0		3	18065*a*	4920·8	4921·5 La. Di.	10	20316*a*
5516·0		5	18124*a*	4920·0	4920·7 La. Di.	10	20319*a*
5513·5		1	18132*a*	4899·0	4899·1 La. Di.	10	20406*a*
5505·0		2	18160*a*	4878·0		1	20494*a*
5502·0	5501·9 La. Di.	2	18170*a*	4860·0	4860·2 La. Di.	8	20570*a*
5500·5	5500·6 La. Di.	8	18175*a*	4849·0		6	20616*a*
5493·0		1	18200*a*	4842·0		2	20647*a*
5491·0		1	18206*a*	4838·5		2	20661*a*
5482·0	5484·1 La. Di.	1	18236*a*	4823·5	4822·7 La. Di.	10	20725*a*
5479·5		1	18245*a*	4808·0	4809·5	8	20792*a*
5475·0		1	18259*a*	4803·0		8	20814*a*
5463·5		1	18298*a*	4799·5		1	20829*a*
5458·0		1	18316*a*	4796·0		1	20845*a*
5454·5	5452·6 La. Di.	8	18328*a*	4759·5		1	21004*a*
5381·0	} 5380·6 {	8	18578*a*	4757·0		1	21015*a*
5380·3		8	18581*a*	4747·5	4746·5 La. Di.	8	21057*a*
5375·5	5376·1	8	18597*a*	4741·5	4741·0 La. Di.	8	21084*a*
5339·5	5340·1	8	18723*a*	4738·5	4740·0 La. Di.	8	21097*a*
5302·5		8	18726*a*	4727·5		6	21147*a*
5301·8	} 5301·3 La. Di. {	3	18856*a*	4719·0		6	21188*a*
5301·0		8	18859*a*	4716·0		2	21198*a*
5279·5		2	18935*a*	‖§4715·0		4	21203*a*
§5276·0		2	18948*a*	4702·0		8	21261*a*
5270·5		4	18968*a*	4699·0		2	21275*a*
5259·0		2	19009*a*	4691·5		8	21309*a*
5252·5		4	19033*a*	4690·0		2	21316*a*
5234·0		4	19100*a*	4687·0		2	21329*a*
5225·0		1	19133*a*	4670·5		8	21405*a*
5211·0		4	19185*a*	4668·0		8	21416*a*
§5203·5	5203·6	4	19212*a*	4662·5		8	21441*a*
	5191·8 La. Di.		19255*b*	4661·0		8	21448*a*
	5190·7 La. Di.		19260*b*	4654·5		10	21478*a*
5187·5	5188·0	8	19272*a*	4619·0		8	21643*a*
5182·5	5182·5	10	19290*a*	4612·5		8	21674*a*
5175·5		6	19316*a*	4605·0		6	21709*a*
5166·5		1n	19350*a*	4579 5		8	21830*a*
5162·5		1	19365*a*	4573 5		8	21858*a*
5158·5		1	19380*a*	4569·5		6	21878*a*
5157·0		4	19385*a*	4567·5		6	21887*a*
5156·0		1	19389*a*	4557·5		10	21935*a*
5144·0		2	19434*a*	4548·5		2	21979*a*
5122·0	5122·2 La. Di.	6	19518*a*	4541·5		1	22012*a*

LANTHANUM—*continued.*

Spark Spectrum		Intensity and Character	Osc. Freq.	Spark Spectrum		Intensity and Character	Osc. Freq.
Thalén	Kirchhoff			Thalén	Kirchhoff		
4525·5		8	22091	4216·5		8	23709
4524·0		6	22098	4202·5		2	23788
4522·0		10	22108	4196·0		10	23825
4499·5		2	22218	4191·5		6	23848
§4455·5		4	22438	4184·0		2	23893
4452·0		2	22455	4151·5		10	24081
4430·0		10	22567	4142·0		6	24136
4427·0		6	22582	4121·0		10	24259
4384·5		6	22801	4098·5		4	24392
4382·5		8	22811	4086·0		10	24467
4377·0		4	22840	4076·5		10	24524
4363·0		4	22913	4048·0		4	24696
4354·0		8	22961	4042 0		8	24733
4330·0		10	23088	4031·0	Lockyer¶	7	24800
4322·0		6	23130		3995·0		25024
4295·0		10	23276		3988·0		25068
4286·0		10	23325	3987·0		4	25074
4280·0		4	23357		3948·1		25321
4274·5		4	23387	3946·5		6	25331
4268·0		10	23423		3928·3		25448
4263·0		8	23451		3926·6		25460
4248·5		4	23531		3920·5		25499
4238·0		10	23589		3915·5		25532
4235·0		6	23606				

* Possibly due to Chlorine. † Double. § See Didymium.
‖ Occurs in Roscoe and Schuster's Terbium Spectrum. ¶ Arc Spectrum.

Lead.

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I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Liveing and Dewar *d*	I.	II.	
6790				3s		14723*a*
6655	†6656·3(6)	6655·8		10sc		15019*b*
	†6452·3(5)	6453·7		6sc		15028*b*
	†6049·2(3)			2sd		16526*b*
6034	†6040·2(5)	6042·6		6nc		16551*b*
	†6009·2(2)			2nd		16636*b*
*5997	†6001·7(4)	6000·3		6nc		16657*b*
5895	†5895·1(4)			2nd		16958*b*
5876	†5874·1(2)			6nc		17019*b*
5853	†5856·6(2)			4nc		17070*b*
5823				n		17168*a*
5776	†5779·1(2)			2nd		17299*b*
*5608	†5607·1(3)			10nc		17829*b*
*5548	†5546·1(6)	5544·8		8nc		18025*b*
	†5523·6(4)			4sd		18099*b*
*5372	†5372·6(6)	5373·4		10nc		18607*b*
5274	†5274·6·2)			2sd		18953*b*
	†5206·7(2)			2sd		19201*b*
*5199	†5201·2(2)			6sc		19221*b*
5190	†5189·2(2)			2sd		19265*b*
5163	†5163·2(3)			4sd		19362*b*
*5044	†5045·1(2)	5043·4		8nc		19815*b*
	†*5004·6(2)			6sd		19976*b*
	†4802·1(1)			2nd		20818*b*
	†4796·6(1)			2nd		20842*b*
4763	†4760·1(1)			4nd		21002*b*
	†4573·1	Hartley		2nd		21855*b*
	†4401·5(1)	and Adeney		2nd		22713*b*
		4399·4		2sd		22724*c*
*4386	†4386·6(4)	4386·4**		9nd		22790*bc*
4271		4271·4		3sd		23404*c*
	†*4246·0(4)	4245·3		9b'd		23546*bc*
		4180·9		2sd		23919*c*
	†*4167·5(2)			6sc		23988*b*
4066	†4062·5 8)	4061·5	(4062·5)	6sc	r	24611*bc*
	†*4058·0(8)	4057·6	(4058·5)	3sd	r	24637*bc*
		4020·5	4019·0	7sc	r	24865*c*
		3961·5		2sd		25242*c*
		3951·7		2sd		25298*c*
		3934·0		3sd		25412*c*
		3927·5		2sd		25454*c*
		3910·4		2sd		25565*c*

LEAD—*continued.*

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
uggins	Thalén *b*	Hartley and Adeney *c*	Liveing and Dewar *d*	I.	II.	
		3853·2		3sd		25944*c*
		3842·9		7sd		26014*c*
		3832·5		7sd		26084*c*
		3827·5		7sd		26119*c*
			3801·0	3sd		26301*d*
		3785·9		7sd		26406*c*
		3738·9	3739·3	7sc		26737*cd*
		3734·3		2sd		26771*c*
		3717·0		3nd		26894*c*
		3709·0		2nd		26953*c*
		3688·8		3sd		27101*c*
		3682·9	3683·3	7sc	8r	27143*cd*
		3671·0	3670·7	7sc		27233*cd*
		3656·1		7sd		27343*c*
		3639·2	3639·3	7sc	8r	27470*cd*
		3591·9		5sd		27832*c*
		3590·5		5sd		27843*c*
		3572·6	3572·0	7sc		27985*cd*
		3563·9		3sd		28050*c*
		3562·2		3sd		28064*c*
		3484·3		3sd		28691*c*
		3455·9		3nd		28927*c*
		3308·9		2sd		30212*c*
		3296·8		3sd		30322*c*
		3278·5		5sd		30492*c*
		3276·9		5sd		30507*c*
			3260·0			30665*d*
		3242·4		5sd		30832*c*
			3238·6			30868*d*
		3219·9	3219·6	3nc		31049*cd*
		3176·0		9nd		31476*c*
		3137·3		7nd		31864*c*
			3118·5			32056*d*
		3088·5		3sd		32369*c*
		3086·7		3sd		32388*c*
		3051·1		3sd		32765*c*
		3043·3		7nd		32849*c*
		3030·2		2sd		32991*c*
		3016·5		3nd		33032*c*
			2981·0		1	33536*d*
		2978·8		2sd		33560*c*
			2973·5		1	33620*d*
			2967·0		1	33694*d*
		2949·2		3nd		33897*c*
		2872·2	2872·0	7sc		34807*cd*
		2867·8		2sd		34859*c*
		2863·2		7sd		34915*c*
			2850·5			35071*d*
		2832·2	2832·9	7sc	10n	35294*cd*
		2822·1	2822·5	7sc	r	35421*cd*
		2801·4	2801·1	10nc	r	35687*cd*
			2721·0			36740*d*
		2716·3		3sd		36804*c*
			2706·1			36941*d*

Magnesium.

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I. Flame Spectrum	II. Spark Spectrum			III. Arc Spectrum	Intensity and Character			Osc. Freq.
Liveing and Dewar *a*	Kirchhoff *b*	Thalén *c*	Liveing and Dewar *d*	Liveing and Dewar *e*	I.	II.	III.	
			5710·7	5710·7		8sc	8sc	17506*d*
		§*5527·4(3)	(5527·4)	‡(5527·4)		8sc	6sc	18086*c*
(5183)	b_1 5183·0	§*5183·1(4)	5183·1	‡5183	10sc	10sc r	10sc r	19288*bcd*
(5172)	b_2 5172·0	§*5172·1(4)	5172·2	‡5172	9sc	9sc r	9sc r	19329*bcd*
(5167)	b_4 5166·9	§*5166·9(4)	5166·6	‡5167	1sc	8sc r	8sc r	19349*bcd*
Bands of Oxide			4808			2sc		20793*d*
		§*4703·6(3)	4703·5	4703·5		8nc	8sc	21254*cd*
		4586·6	(4586·6)			4nc		21796*c*
4570·5			4570·5	4570·5	10sc	2sc	10sc r	21873*d*
	4480·9	§*†4481·0	(4481)			8nd		22305*bc*
	Hartley and Adeney	Cornu		4351·2		4s	8sc	22975*c*
				4166·0		4s	8sc	23997*c*
			4057·3	4057·3		4s	4sc	24640*d*
	3896·0		3895·0			4sd		25663*bd*
	3892·0		3893·0			4sd		25683*bd*
3865					4b			25865*a*
3860					4b			25899*a*
3858					4b			25912*a*
3855	3855·5		3852		4b	4sd		25929*b*
3848	3849·5		3847		4b	4sd		25969*b*
3845					4b			26000*a*
3841					4b			26027*a*
(3838)	3837·9	3837·6	(3837·6)	(3837·6)	10s	10sc r	10sc r	26048*bc*
(3831)	3832·1	3831·5	(3831·5)	(3831·5)	10s	10sc r	10sc r	26089*bc*
(3829)	3829·2	3829·0	(3829·0)	(3829·0)	10s	10sc r	8sc r	26108*bc*
3824					4b			26142*a*
3815					4b			26205*a*
3810					4b			26239*a*
3806					4b			26267*a*
3799					4b			26315*a*
3790					4b			26378*a*
3782					4b			26432*a*

* Observed, together with the Bands of the Oxide, by Lecoq de Boisbaudran in the Spark Spectrum of solution of Magnesium Chloride.
† 4480·1, Hartley and Adeney.
‡ 5527·5, 5183·0, 5172·0, 5166·7, Fievez.
§ Observed also by Lockyer in the Spectrum of the Spark between metallic poles; the 'indices' attached to these numbers denote the comparative 'lengths' of the lines.
b_4 See Iron; the Fraunhofer line b_4 is double.

MAGNESIUM—*continued.*

I. Flame Spectrum	II. Spark Spectrum			III. Arc Spectrum	Intensity and Character			Osc. Freq.
Liveing and Dewar *a*	Hartley and Adeney *b*	Cornu *c*	Liveing and Dewar *d*	Liveing and Dewar *e*	I.	II.	III.	
3777					4b			26468*a*
3772					4b			26503*a*
3765	3765·2				4b	2nd		26551*b*
3756					4b			26616*a*
3750					4b			26659*a*
3730					10n			26802*a*
3724					10n			26845*a*
3720					10n			26874*a*
	3336·2	3334·2	(3334·2)	(3334·2)		6sc	8sc	29974*bc*
	3331·8	3330·0	(3330·0)	(3330·0)		6sc	8sc	30013*bc*
	3329·1	3327·0	(3327·0)	(3327·0)		6sc	7sc	30039*bc*
		3278·4		?		5sc	?	30494*c*
	3139·3					2sd		31844*b*
	3134·2					2sd		31896*b*
	3107·0					4nd		32175*b*
	3096·2	3095·6	(3095·6)	(3095·6)		10sc	10sc r	32291*bc*
	3091·9	3091·9	(3091·9)	(3091·9)		8sc	10sc r	32333*bc*
	3089·9	3090·0	(3090·0)	(3090·0)		8sc	8sc r	32353*bc*
	3071·6					5sd		32546*b*
	3046·0					2sd		32820*b*
	2941·6			2942		2sd	6sc	33985*b*
			2940·3			2sd		34000*c*
				2938·5			6sc	34021*e*
				2937·5			6sc	34032*e*
	2935·8	2934·9	(2934·9)	(2934·9)		10nc	1sc	34058*bc*
	2928·1	2926·7	(2926·7)	(2926·7)		10nc	1sc	34150*bc*
	2913·8		2913·2	2913·2		8sd	1sc	34313*bd*
	2884·3					3nd		34660*b*
(2850·3)	2851·2	2850·3	2851·8	2851·8	10sc r	10ncr	10ncr	35063*bcd*
	2847·9					1sc		35102*b*
	2845·9					1sc		35127*b*
	2815·3					2nd		35509*b*
	2810·0					2nd		35576*b*
	2801·6	2801·3	2802·4	2802·4		10sc r	10sc r	35680*bcd*
	2796·9	(2797·1)	(2797·1)			9sc		35742*b*
	2794·1	2794·5	2795·2	2795·2		10sc r	10sc r	35772*bcd*
	2789·6	2789·9	(2789·9)			9sc		35834*bc*
	2781·8		2782·2	2782·2		6sc	5sc r	35934*bd*
	2780·2		2780·7	2780·7		6sc	5sc r	35954*bd*
	2778·7		2779·4	2779·4		8sc	6sc r	35971*bd*
	2776·9		2778·2	2778·2		6sc	5sc r	35992*bd*
	2775·5		2776·9	2776·9		6sc	5sc r	36009*bd*
				2767·5			5sc	36122*e*
				2764·5			5sc	36161*e*
	2736·0			2736		2sd	6ncr	36538*be*
	2734·3			2732·5		2sd	6ncr	36572*be*
				2731			4ncr	36604*e*
				2698			6sc	37053*e*
				2695			6sc	37095*e*
				2693·5			4sc	37115*e*
				2672·5			5ncr	37407*e*
				2670			5ncr	37442*e*
				2668·5			3nc	37463*e*

MANGANESE—*continued*,

I. Spark Spectrum		II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalen *b*	Ångström *c*	Thalén *d*	Cornu *e*	I.	II.	
			4359·3			4	22933*d*
			4338·5			2	23043*d*
			4337·8			2	23046*d*
			4337·0			6	23051*d*
			4335·4			4	23059*d*
			4325·3			10	23113*d*
			4322·7			2	23127*d*
			4320·6			2	23138*d*
			4314·3			1	23172*d*
			4300·6			4	23246*d*
			4300·1			4	23248*d*
			4299·6			2n	23251*d*
			4283·9			6	23336*d*
*4281	†4280·5(3)	4280·4	4280·7		6sc	6	23355*bcd*
			4271·6			10	23403*d*
*4267	†4265·0(3)	4264·9	4265·7		6sc	7	23440*bcd*
			4261·0			4	23462*d*
*4259	†4258·2(3)	4258·1	4260·3 4257·4		6sc	6 6	23476*bcd*
*4237	†4234·8(3)	4234·6	4234·8		10sc	8	23607*bcd*
	†4227·0(4)	4227·0			10sc		23650*bc*
			4220·5			4	23687*d*
	*†4083·5(3)	4083·3			6sc		24482*bc*
	†4083·0(3)	4082·7			2sc		24485*bc*
	†4079·6(3)	4079·6			6sc		24504*bc*
	*†4062·9(2)	4062·9			2sd		24606*bc*
	*†4054·4(2)	4054·3			6sc		24658*bc*
	*†4048·2(2)	4048·0		4048·7	6sc		24694*bce*
	*†4040·6(3)	4040·6	Liveing	4040·6	6sc		24741*bce*
	†4034·0(3)	4034·9	and Dewar	4034·9	2sd		24776*bce*
	†4032·9(3)	4032·9	(4032·9)	4033·8	2sd	r	24787*bce*
	†4031·8(3)	4031·8	(4031·8)	4032·7	6sc	r	24794*bce*
	†4029·5(3)	4029·4	(4029·5)	4029·9	6sc	r	24809*bce*
			Lockyer				
			3991·7				25044*d*
			3989·2				25060*d*
	†3988·2(3)	3988·0			2sd		25067*bc*
		3986·3					25078*c*
		3986·0					25080*c*
		3984·6					25089*c*
			3976·2				25142*d*
			3974·8				25151*d*
			3953·4				25287*d*
				3952·0			25296*e*
			3951·9				25297*d*
			3950·9				25303*d*
			3942·2				25359*d*
			3928·8				25445*d*
			3925·7				25465*d*
			3923·4				25480*d*
			3922·5				25486*d*
			3921·8				25491*d*
			3920·8				25497*d*

MANGANESE—*continued.*

I. Spark Spectrum		II. Arc Spectrum			Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Ångström *c*	Lockyer *d*	Cornu *e*	I.	II.	
			3917·5				25519*d*
			3910·7				25563*d*
			3910.4				25564*d*
				3881·8			25753*d*
				3824·0			26142*e*
				3806·4			26264*e*

* Observed, together with the Bands of Manganese Oxide, by Lecoq de Boisbaudran in the Spark Spectrum of Manganese Chloride solution.
† Observed also by Lockyer; the 'indices' attached to these numbers denote the comparative 'lengths' of the lines. ‡ 'Could not be identified,' Lockyer. § Observed also by Liveing and Dewar.
‖ More refrangible than the iron line.

MERCURY.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil. Trans.' 1864, p. 139.
Gladstone, 'Phil. Mag.' xx. p. 249.
Plücker, 'Pogg. Ann.' cvii. p. 497.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Liveing and Dewar, 'Phil. Trans.' clxxiv. p. 218, 1883.
Hartley and Adeney, 'Phil. Trans.' clxxv. p. 136, 1884.
Pearce, 'Wied. Ann.' vi. p. 597.
Vogel, 'Berlin. Monatsb.' 1879, p. 586.

Spark Spectrum				Intensity and Character	Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Hartley and Adeney *d*		
6383				1	15662*a*
6360				1	15719*a*
6144	6151·2	6151·0		10sc	16252*bc*
6088				1	16421*a*
5885	5888·1			8nc	16979*b*
5871	5871·1			4sd	17028*b*
5817				1	17186*a*
5800				1	17236*a*
5788	*5789·6	5790·3		10nc	17266*bc*
5768	*5768·1	5768·1		10nc	17332*bc*
5678	*5678·1	5678·2		8nc	17606*bc*
5594	*5595·1			6nd	17867*b*
5460	*5460·6	5459·8		10nc	18309*bc*
5425	5426·1	5425·8		8nc	18425*bc*
5364	5364·6			4nd	18635*b*
5281	5278·6			2nd	18940*b*
5218	5217·2			2nd	19162*b*
	5206·2			4nd	19202*b*
5132	5131·2			4nd	19483*b*
4959	4958·1			6nd	20163*b*
4918	*4916·1			4nd	20335*b*

MERCURY—*continued.*

Spark Spectrum				Intensity and Character	Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Hartley and Adeney *d*		
4826				1	20718*b*
4357	*4358·1	4350·6	4358·0	10sc	22943*bd*
			4348 0	2sc	22992*d*
			4341·0	2sc	23033*d*
			4077·5	3nc	24515*bd*
	*4078·5		4046·5	10nc	24703*bd*
4055	*4047·0		3984·0	8sc	25097*bd*
3990	3982·2		3859·0	3nc	25905*d*
			3820·0	3nc	26170*d*
			3807·0	2sc	26260*d*
			3800·0	2sc	26315*d*
			3790·0	8sc	26385*d*
			3770·0	3sc	26517*d*
			3754 7	2sc	26625*d*
			3751·0	8sc	26652*d*
			3681·9	3nc	27152*d*
			3662·9	5nc	27293*d*
			3654·4	6nc	27356*d*
			3632·9	7nc	27518*d*
			3560·1	8sc	28080*d*
			3542·3	8sc	28221*d*
			3492·6	1sd	28623*d*
			3473·4	1sd	28781*d*
			3451·4	1sd	28965*d*
			3389·5	8nc	29494*d*
			3365·5	2sd	29704*d*
			3351·2	3nc	29831*d*
			3341·2	8sc	29920*d*
			3326·4	2sc	30054*d*
			3207·1	3sc	31171*d*
			3130·4	10nc	31935*d*
			3124·5	10nc	31996*d*
			†3094·0	2sc	32310*d*
			3021·0	8nc	33092*d*
			2966·4	10nc	33701*d*
			2946·6	8sc	33927*d*
			2935·5	3sd	34055*d*
			2925·2	3sc	34175*d*
			2915·3	3sc	34291*d*
			2892·9	8sc	34556*d*
			2846·8	10nc	35116*d*
			2832·1	2sc	35298*d*
			2819·7	8nc	35453*d*
			2810·0	2nd	35576*d*
			2804·5	6sc	35656*d*
			2798·5	3nc	35722*d*
			2790·0	3sc	35831*d*
			2773·2	2nd	36048*d*
			2760·8	3sd	36210*d*
			2751·5	6sc	36332*d*
			2702·0	2nd	36999*d*
			2657·6	3nd	37617*d*
			2652·2	8nc	37693*d*
			2644·6	2nd	37801*d*
			2640·6	2nd	37859*d*

MERCURY—*continued.*

Spark Spectrum Hartley and Adeney	Intensity and Character	Osc. Freq.	Spark Spectrum Hartley and Adeney	Intensity and Character	Osc. Freq.
2602·3	6sd	38416	2390·0	1nc	41828
2584·2	2sd	38685	2355·2	3nc	42448
2575·3	2nd	38818	2342·2	1nc	42682
‡2535·8	10sc	39440	2340·0	1nd	42719
2533·8	8nc	39456	2315·2	1nc	43180
2522·7	1nd	39629	2296·5	1sc	43531
2514·3	1nd	39761	2292·6	1nc	43605
2491·4	8sc	40127	2264·2	6sc	44152
2484·2	2nc	40243	2263·3	6sc	44166
2477·7	1nd	40361	2261·4	8nc	44207
2468·0	2nd	40507	2254·0	8sc	44352
2467·0	2nd	40523	2231 0	1sc	44809
2463·7	2nd	40578	2225·7	8nc	44916
2459·3	1nd	40650	2190·9	1sc	45629
2414·3	8sc	41408	2148·0	1sc	46540
2407·3	8sc	41528			

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Mercuric Chloride solution, together with the following additional lines :—5647, 5620, 5561. 5529, 5498. 5314, 5292, 5269, 5246, 5222.
† Possibly due to an impurity. ‡ Liveing and Dewar, 2536·8, in arc reversed.

MOLYBDENUM.

Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lockyer, 'Phil. Trans.' clxxiii. p. 561, 1881 ; 'Proc. Roy. Soc.' xxvii. p. 280.

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Thalén	Lockyer	I.	II.		Thalén	Lockyer	I.	II.	
6029·2		10sc		16581	4475·1		4sd		22339
5887·6		10nc		17891	4433·6		4sd		22548
5856·6		8sc		17062	4411·6		4sd		22661
5791·1		6sd		17263	4380·5		4sd		22822
5750·1		6sd		17386	4326·0		4sd		23109
5687·6		6sd		17577	4277·5		6nc		23371
5649·1		4sd		17697		3999·8			24994
5631·1		4sd		17753		3997·5			25008
5569·1		10sc		17951		3993·2			25031
5540·1		2sd		18045		3992·4			25039
5531·6		10sc		18073		3991·0			25049
5505·1		10sc		18160		3990·6			25051
5360·1		4nd		18651		3985·5			25083
4979·1		2sd		20078		3982·1			25105
4867·6		4nd		20538		3981·5			25109
4829·6		4sd		20700		3981·0			25112
4818·1		4sd		20749		3980·6			25114
4757·6		4sd		21013		3979·7			25120
4730·6		4sd		21133		3979·1			25124
4706·6		4sd		21240		3978·3			25129
	4576·0			21847		3976·8			25138
4536·1		4sd		22039		3974·8			25151

MOLYBDENUM—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Thalén	Lockyer	I.	II.		Thalén	Lockyer	I.	II.	
	3967·6			25197		3928·0			25450
	3957·6			25260		3922·9			25484
	3954·2			25282		3921·2			25488
	3952·9			25280		3917·0			25522
	3946·0			25334		3916·7			25524
	3944·2			25346		3916·0			25528
	3942·5			25357		3914·8			25536
	3942·2			25359		3902·4			25617
	3934·0			25412		3901·3			25625
	3929·5			25414					

NICKEL.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Angström, 'Recherches sur le Spectre Solaire,' Upsal. 1868.
Lockyer, 'Phil. Trans.' clxiii. p. 369, 1873; clxxiii. p. 561, 1881.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Cornu, 'Spectre Normale du Soleil,' Paris, 1881; 'Journ. de l'Ecole Polytechnique,' liii. 1883.

I. Spark Spectrum		II. Arc Spectrum		Intensity and Character	Osc. Freq.
Thalén *a*	Kirchhoff *b*	Ångström *c*	Cornu *d*	I.	
*†6175·9(3)	6175·5	6175·9		6nc	16188*abc*
†6115·5(2)	6115·7	6115·2		4sd	16347*abc*
*†6107·7(2)	6108·2	6107·1		4sd	16368*abc*
			6011·2		16631*d*
			6006·3		16644*d*
			5996·8		16671*d*
			5995·7		16674*d*
			5899·8		16945*d*
†5892·1(2)	5892·2	5892·1	‡5891·9	10sc	16967*abcd*
			5883·7		16991*d*
*†5856·6(2)	5857·3			4sd	17069*ab*
*†5476·0(4)	5475·8	5476·0		6sc	18256*abc*
*†5175·8(2)	5176·2	5175·8		2sd	19315*abc*
b_3*†5168·5(2)	5168·3	5168·5		2sd	19342*abc*
*†5155·3(2)	5154·6	5155·2		2sd	19393*abc*
*†5145·9(2)	5145·9	5145·9		2sd	19427*abc*
†5142·2(2)	5141·6	5141·8		2sd	19442*abc*
*†5137·5(2)	5136·5	5136·8		2sd	19461*abc*
*†5115·0(2)	5114·7	5115·0		2sd	19545*abc*
*†5099·8(3)	5099·3	5099·3		2sd	19604*abc*
†5098·6(3)	5098·8	5098·4		2sd	19607*abc*
*†5080·7(3)	5080·5	5080·7		2sd	19677*abc*
†5079·8(3)	5080·0	5079·6		2sd	19681*abc*
*†5034·7(2)	5034·7	5034·8		6sc	19856*abc*
*†5016·6(3)	5017·1	5016·7		6sc	19927*abc*

b_3 See Iron; the Fraunhofer line b_3 is double.

NICKEL—*continued.*

I. Spark Spectrum		II. Arc Spectrum		Intensity and Character	Osc. Freq.
Thalén *a*	Kirchhoff *b*	Ångström *c*	Cornu *d*	I.	
*†4983·4(2)	4982·7	4983·4		2sd	20061*abc*
†4979·7(2)	4979·7	4979·4		2sd	20076*abc*
*†4935·2(3)	4935·0	4935·2		6sc	20257*abc*
*†4917·7(1)	4917·9	4917·7		6sc	20329*abc*
*†4904·0(3)	4903·5	4903·9		6sc	20386*abc*
*†4873·0(1)	4872·8	4873·0		10sc	20516*abc*
*†4865·4(2)	4866·0	4865·5		10sc	20547*abc*
*†4854·8(3)	4855·6	4854·6		10sc	20592*abc*
*†4830·3(2)	4830·8	4830·2		2sd	20696*abc*
†4828·5(2)	4828·7	4828·3		2sd	20704*abc*
*†4785·9(2)	4785·3	4785·8		8sc	20881*abc*
*†4755·1(3)	4755·3	4754·9		2sd	21024*abc*
*†4713·8(4)	4713·6	4713·8		10sc	21208*abc*
*†4647·1(3)	4646·7	4647·0		2sd	21513*abc*
*†4401·8(4)		4401·9		2sd	22711*abc*
		Lockyer			
		3972·7			25163*c*
		3971·2			25172*c*
		3969·2			25185*c*
			3641·0		27457*d*
			3618·3		27629*d*
			3572·9		27980*d*
			3570·8		27996*d*
			3565·0		28042*d*
			3523·9		28369*d*
			3514·7		28443*d*
			3510·2		28480*d*
			3491·9		28629*d*
			3470·4		28806*d*
			3461·5		28880*d*
			3457·8		28911*d*
			3445·7		28929*d*
			3436·0		29095*d*
			3431·8		29131*d*
			3422·1		29213*d*
			3419·5		29235*d*
			3418·8		29241*d*
			3413·2		29289*d*
			3391·4		29478*d*
			3389·8		29492*d*
			3378·7		29588*d*
			3372·9		29639*d*
			3372·4		29644*d*
			3370·6		29660*d*
			3367·8		29684*d*
			3365·3		29706*d*
			3364·5		29713*d*
			3363·9		29719*d*
			3360·3		29750*d*
			3359·8		29755*d*
			3320·8		30104*d*
			3320·3		30109*d*
			3313·4		30171*d*
			3310·0		30202*d*

NICKEL—*continued.*

Arc Spectrum Cornu	Intensity and Character	Osc Freq.	Arc Spectrum Cornu	Intensity and Character	Osc. Freq.
3248·6		30773	3053·3		32742
3242·3		30833	3049·6		32781
3231·3		30938	3036·7		32921
3212·7		31117	3030·3		32990
3134·4		31894	3011·2		33199
3134·0		31898	3003·1		33289
S_1 3100·7		32137	3002·0		33301
S_1 3100·5		32242	2992·0		33412
3056·3		32710			

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Nickel Chloride solution, as also the following lines :—6315, 6261, 5827, 5801. 5756, 5716, 5695, 5665, 5641 (double), 5621, 5609, 5588, 5129, 5048, 4998, 4950, 4808, 4762, 4732, 4606, 4594, 4571, 4550, 4471, 4161, 4327, 4288.

† Observed also by Lockyer; the 'indices' attached to these nnmbers denote the comparative 'lengths' of the lines. ‡ 5891·9 Thollon.

NITROGEN.

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Plücker, 'Pogg. Ann.' cv. p. 76, 1858; cvii. p. 519, 1859.
Vander Willigen, 'Pogg. Ann.' cvi. p. 610, 1859.
Huggins, 'Phil. Trans' cliv. p. 144, 1864.
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Brassak, 'Abh. Nat. Ges. Halle,' x. 1866.
Wüllner, 'Pogg. Ann.' cxxxv. p. 524, 1868; cxxxvii. p. 356, 1869; cxlvii. p. 325, 1872; cxlix. p. 103, 1873.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Salet, 'Ann. Chim. Phys.' (4) xxviii. p. 52; 'Compt. Rend.' lxxxii. pp. 223,' 274, 1876.
Angström and Thalén, 'Nova Acta Upsal.' (3) ix. 1875.
Vogel, 'Pogg. Ann.' cxlvi. p. 569.
Schuster, 'Proc. Roy. Soc.' xx. p. 484; 'Nature,' viii. p. 161.
Hartley and Adeney, 'Phil. Trans.' clxxv. 91.
Hasselberg, 'Mem. Acad. St. Petersbourg,' xxxii. No. 15, 1885.

Spark Spectrum or Elementary Line Spectrum				Intensity and Character	Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Hartley and Adeney *d*		
6602*†	6602·3§	6603·1		4s	15142*b*
6482*†	6479·8§	6479·9		5s	15428*b*
5950*†	5949·2	5949·6		4s	16804*b*
5942*†	5941·7	5940·2		10n	16825*b*
5930*†	5932·1§	5931·9		10n	16853*b*
5925*†	5929·6	5929·2		4s	16860*b*
5768*†	5767·1			4s	17335*b*
5746†	5745·1			4s	17401*b*
5726				1s	17459*a*
5709*†	5711·1§	5710·8		4s	17505*b*
5686*†	5685·6	5685·6		4s	17583*b*
5680*†	5678·1§	5678·1		10n	17606*b*
5675*†	5674·6	5674·6		6s	17617*b*

NITROGEN—*continued.*

Spark Spectrum or Elementary Line Spectrum				Intensity and Character	Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Hartley and Adeney *d*		
5668*†	5666·1	5666·6		10n	17644*b*
5550*†	5549·1			4s	18016*b*
5541*†	5541·1			6s	18042*b*
5534†	5534·1§			8n	18065*b*
5530*†	5530·1			6s	18078*b*
5524*				1s	18098*a*
5495*†	5495·1§			7n	18199*b*
5479*†	5479·1			6s	18246*b*
5462*†	5461·6			4s	18304*b*
5453*†	5453·1§			3s	18333*b*
5350	5351·1			2s	18682*b*
5338*	5339·6			2s	18722*b*
5319	5320·1			2s	18791*b*
5179	5184·7			5n	19282*b*
5176	5178·2			4s	19306*b*
5172	5172·2			2s	19329*b*
5071*				2s	19333*a*
5045†§	5045·1	5043·3		8s	19815*b*
5024*†	5025·1			8s	19894*b*
5016*†	5016·1			6s	19930*b*
5010*†	5010·1			6s	19954*b*
5007	5006·6			4s	19968*b*
5003*†§	5005·1	5004·6		10n	19974*b*
4999*†§	5002·1	5000·6		10n	19986*b*
4993*†	4993·6			6s	20020*b*
4986*†	4987·1			6s	20046*b*
4931				1s	20274*a*
4895*†	4895·6			4s	20420*b*
4880*				1s	20486*a*
4866				1s	20545*a*
4858*†				4s	20579*a*
4849*†				4s	20617*a*
4804*†§	4803·1			8s	20814*b*
4788†§	4788·1			8s	20879*b*
4781†	4779·1			10s	20918*b*
4640	4640·2			6s	21090*b*
4629*†§	4630·6	4629·8	4628·9	8s	21593*bcd*
4621*†	4621·1	4620·7	4619·9	5s	21636*bcd*
4613*†	4613·1	4612·8	4612·3	5s	21673*bcd*
4608*†§	4606·6	4606·6	4605·6	6s	21703*bcd*
4600*†§	4601·1	4601·0	4600·1	6s	21729*bcd*
4553*†			4553·2	2b	21956*d*
4533*†			4530·1	3n	22068*d*
4506*			4506·6	3s	22183*d*
4496				1s	22235*a*
4490				1s	22265*a*
4477			4476·6	3s	22332*d*
4448*†§	4446·6	4446·3	4446·1	7s	22485*d*
4430*†§	4432·1		4432·6 4425·9	3b 3n	22554*d* 22588*d*
4398†				4s	22731*a*
4347†	4347·5		4348·2	6s	22991*d*
4238*†	230·0		4236·4 4228·9	6n	23598*d* 23640*d*
4206*			4206·3	2n	23766*d*

NITROGEN —*continued*.

Spark Spectrum or Elementary Line Spectrum				Intensity and Character	Osc. Fre
Huggins *a*	Thalén *b*	Kirchhoff *c*	Hartley and Adeney *d*		
4170*†			4176·8 4169·2	4n	23935*c* 23979*a*
4142* 4130*	4137·0		4145·4 4132·8	5s 5s	24122*a* 24190*a*
4101†			4102·6	5s	24368*a*
4094*			4096·5	5s	24404*a*
4038†	4040·1		4041·7	5n	24735*a*
4000†	3995·1		3994·5	8s	25027*d*

* Observed also by Plücker, who gives also Nitrogen lines at 6376, 6358, 6341, 6288, 6249, $\frac{6165}{6152}$, 5754, 556 5330, 5309, 5164, $\frac{5160}{5152}$, 5120, 5098, 4743, 4732, 4644 and $\frac{4151}{4147}$, of which 5309, 5164 and 4644 have also be noted by Salet.

† Observed also by Salet.

§ Observed also by Lecoq de Boisbaudran.

NITROGEN.

Band Spectrum			Intensity and Character		Osc. Freq.
I. Negative	II. Positive				
Ångström and Thalén *a*	Lecoq de Boisbaudran *b*	Ångström and Thalén † *c*	I.	II.	
		6870·0		4b^r	14552*c*
		6785·7		6b^r	14733*c*
	6752	6778·6		4b^r	14748*c*
		6760·0		3b^r	14788*c*
		6701·0		6b^r	14919*c*
	6682	6693·4		4b^r	14936*c*
		6673·5		3b^r	14980*c*
		6621·8		6b^r	15098*c*
	6604	6614·2		4b^r	15115*c*
		6594·7		3b^r	15159*c*
		6542·3		6b^r	15281*c*
	6524	6533·8		4b^r	15302*c*
		6516·3		3b^r	15342*c*
		6465·5		6b^r	15462*c*
	6448	6458·6		4b^r	15479*c*
		6440·6		3b^r	15522*c*
		6392·5		6b^r	15639*c*
	6375	6384·8		4b^r	15658*c*
		6366·8		3b^r	15702*c*
		6321·0		9b^r	15816*c*
	6306	6313·8		7b^r	15834*c*
		6294·9		5b^r	15882*c*
		6249·2		9b^r	15997*c*
	6233	6242·6		7b^r	16014*c*
		6225·5		5b^r	16058*c*

NITROGEN—*continued.*

Band Spectrum					Intensity and Character		Osc. Freq.
I. Negative			II. Positive				
alet *a*	Lecoq de Boisbaudran *b*	Ångström and Thalén *c*	Lecoq de Boisbaudran *b*	Ångström and Thalén *c*	I.	II.	
				6183·2		5b^r	16168*c*
	6171	*	6171	6175·1		4b^r	16189*c*
	6161			6158·2		3b^r	16234*c*
144				6125·4		4b^r	16321*c*
087	6108		6108	6118·8		3b^r	16338*c*
				6102·1		2b^r	16383*c*
				6066·3		6b^r	16480*c*
030	6048		6048	6060·6		4b^r	16495*c*
				6043·3		3b^r	16542*c*
				6011·8		6b^r	16629*c*
	5994	*	5994	6004·6		4b^r	16649*c*
973				5987·8		3b^r	16696*c*
				5957·3		6b^r	16781*c*
	5943	*	5943	5950·5		4b^r	16800*c*
913				5933·3		3b^r	16849*c*
				5904·6		6b^r	16931*c*
	5891	*	5891	5897·5		4b^r	16951*c*
860				5882·5		3b^r	16995*c*
				5853·0		9b^r	17080*c*
	5839		5839	5846·1		7b^r	17100*c*
				5830 5		5b^r	17146*c*
802				5801·8		9b^r	17231*c*
	5790		5790	5795·3		7b^r	17250*c*
				5780·6		5b^r	17294*c*
				5752·0		9b^r	17380*c*
748	5737	*	5737	5745·6		7b^r	17399*c*
				5730·7		5b^r	17445*c*
	5695		5695	5703·8		4b^r	17527*c*
	5680		5680	5682·5		2b^r	17593*c*
			5650	5657·9		4b^r	17669*c*
				5637·2		2b^r	17734*c*
				5612·6		4b^r	17812*c*
	5600		5600	5594·2		2b^r	17870*c*
				5567·9		6b^r	17954*c*
	5557		5557	5563·0		4b^r	17970*c*
				5551·8		3b^r	18007*c*
				5525·2		6b^r	18093*c*
				5518·7		4b^r	18115*c*
				5506·0		3b^r	18157*c*
				5513·4		6b^r	18132*c*
				5493·7		3b^r	18197*c*
				5482·8		6b^r	18234*c*
				5476·9		6b^r	18253*c*
				5472·6		4b^r	18268*c*
17	5457		5457			2n	18320*b*
				5441·9		9b^r	18371*c*
				5437·0		7b^r	18387*c*
				5422·1		5b^r	18438*c*
				5406·4		9b^r	18491*c*
				5401·7		7b^r	18507*c*
				5387·4		5b^r	18556*c*
				5371·7		9b^r	18610*c*
				5366·7		7b^r	18628*c*
				5353·2		5b^r	18675*c*

Band Spectrum					Intensity and Character		Osc. Freq.
I. Negative			II. Positive				
Salet *a*	Lecoq de Boisbaudran *b*	Ångström and Thalén *c*	Lecoq de Boisbaudran *b*	Ångström and Thalén *c*	I.	II.	
5320	5330		5330	5339·7		3b^r	18722*c*
5280	5302		5302	5306·3		3b^r	18840*c*
				5273·8		6b^r	18956*c*
				5256·3		3b^r	19019*c*
				5244·6		6b^r	19061*c*
				5239·3		4b^r	19081*c*
		5227·5			6b^r		19124*a*
	ι5223		5222	5226·5		3b^r	19127*c*
				5213·1		9b^r	19177*c*
				5207·7		7b^r	19196*c*
				5196·1		5b^r	19239*c*
				5183·4		9b^r	19286*c*
			5177	5179·3		7b^r	19302*c*
				5165·8		5b^r	19352*c*
				5153·7		6b^r	19398*c*
	κ5148	5150·0			3b^r		19412*c*
				5149·0		4b^r	19416*c*
				5138·7		3b^r	19454*c*
				5126·5		6b^r	19501*c*
				5097·7		6b^r	19611*c*
α5065	5064		5064	5065·6		6b^r	19735*c*
β5030				5032·0		6b^r	19867*c*
	θ5003						19982*b*
γ4973	4973		4973	4972·0		6b^r	20107*c*
δ4910	4915		4916	4919·0		6b^r	20323*c*
	4861						20565*b*
ε4810	4814		θ4814	4813·0		6b^r	20771*c*
	4724		ι4724	4722·0		6b^r	21171*c*
ζ4715	β4706	4709·3			7b^r		21228*c*
			η 4663	4666·0		6b^r	21425*c*
		4653·5			6b^r		21483*c*
η 4660	4648		4644	4649·0		6b^r	21503*c*
4640	4601	4601·2			5b^r		21727*c*
θ4576	4576		ε4576	4574·0		6b^r	21856*c*
		4555·2			4b^r		21946*c*
		4516·5			3b^r		22134*c*
μ4491	η4492		δ4492	4489·0		6b^r	22270*c*
ν4413	4414		ζ4414	4417·0		6b^r	22633*c*
4350							
ξ4340	ζ4345		α4345	4346·0		6b^r	23003*c*
π4273	α4276	4281·0			5b^r		23352*c*
	4267		β4269	4271·0		6b^r	23407*c*
	δ4233	4239·0			4b^r		23583*c*
ρ4200	4200	4203·0	γ4200	4203·0	3b^r	6b^r	23786*c*
		4175·0			2b^r		23945*c*
				4144·0		5b^r	24124*c*
σ4138	4139		4139				24153*b*
τ4090	4093		4093	4098·0		2b^r	24395*c*
φ4060	4062		4062	4063·0		5b^r	24605*c*
ψ3995	4000		4000	4002·0		3b^r	24980*c*
				3952·0		1b^r	25296*c*

* Other feeble maxima observed by Ångström and Thalén in the *negative* band spectrum at about 5750 5900, 6000, 6180, 6320, 6470, 6600.

† Called by Ångstrom and Thalén, 'le spectre du bioxyde d'azote.'

Osmium.

Huggins, 'Phil. Trans.' 1864, p. 139.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Fraser, 'Chem. News,' viii. p. 34.
Lockyer, 'Phil. Trans.' clxxiii. p. 561, 1881.

Spark Spectrum		Intensity and Character	Osc. Freq.	Spark Spectrum		Intensity and Character	Osc. Freq.
Huggins *a*	Thalén *b*			Huggins *a*	Thalén *b*		
6460		2s	15475*a*	5414		3s	18465*a*
6280		1s	15919*a*	5201		1s	19221*a*
5991		1s	16687*a*	5073		1s	19706*a*
5858		2s	17066*a*	4550		1s	21969*a*
5777		1s	17305*a*	4419	4422·1	8sd	22607*b*
5719		2s	17480*a*	4357		2s	22948*a*
5582		2s	17910*a*	4311		2s	23190*a*
5521		4s	18107*a*	4294		2s	23281*a*
5440		1s	18377*a*	4260		6s	23467*a*

Lockyer has observed the following lines in the Arc Spectrum of Osmium between wave-lengths 3900 and 4000 :—3990·4, 3975·5, 3962·7, 3918·3.

Oxygen.

Ångström, 'Pogg. Ann.' xciv. p. 141 (1855) ; 'Phil. Mag.' xlii. p. 397.
Plücker, 'Pogg. Ann.' cvii. p. 518, 1859.
Huggins, 'Phil. Trans.' cliv. p. 146, 1864.
Plücker and Hittorf, 'Phil. Trans.' clv. p. 23, 1865.
Brassak, 'Abh. Nat. Ges. Halle,' x. 1866.
Wüllner, 'Pogg. Ann.' cxxxv. p. 515, 1868 ; cxxxvii. p. 350, 1869 ; cxliv. p. 481, 1872 ; cxlvii. p. 329 ; 'Wied. Ann.' viii. p. 253, 1879.
Salet, 'Ann. Chim. Phys.' (4) xxviii. p. 52, 1873.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Ångström and Thalén, 'Nova Acta Soc. Upsal.' (III.) ix. 1875.
Schuster, 'Phil. Trans.' clxx. p. 37, 1879 ; 'Wied. Ann.' vii. p. 670, 1879.
Paalzow and Vogel, 'Wied. Ann.' xiii. p. 336.
Piazzi Smyth, 'Phil. Trans. Ed.' xxx. p. 419, 1882 ; 'Phil. Mag.' (5) xiii. p 330.
Vogel, 'Pogg. Ann.' cxlvi. p. 569.

I. Compound Line Spectrum	II. Elementary Line Spectrum				III. Negative Glow Spectrum	Intensity and Character			Osc. Freq
Schuster *a*	Huggins *b*	Hartley and Adeney *c*	Thalén *d*	Schuster *e*	Schuster *f*	I.	II.	III	
6156·9	6171*‖		6170·7**‡			6s	5s		16201*d*
									16237*a*
					6010 to 5960			b	16634 to 16773 *f*
					5900 to 5840			b	16944 to 17118 *f*

OXYGEN—*continued.*

I. Compound Line Spectrum	II. Elementary Line Spectrum				III. Negative Glow Spectrum	Intensity and Character			Osc. Freq.
Schuster *a*	Huggins *b*	Hartley and Adeney *c*	Thalén *d*	Schuster *e*	Schuster *f*	I.	II.	III.	
					5630 to 5553 †††			b	17757 to 18003 *f*
5435·6						6s			18392*a*
5329·4						6s			18758*a*
					5292 to 5205 ¶			b	18891 to 19206 *f*
	5205			5205·4§‡			6s		19205*e*
	5190*		5189·7	5189·6§‡			4s		19264*de*
			5178·2*	5175·4‖§‡			3s		19317*e*
	5163*§‡						2s		19363*b*
				5159·3§			5s		19377*e*
	4953*			4954·4§			3s		20178*e*
	4943*		4941·1‖	4942·2‡§			8n		20228*e*
				4940·2‡§			5n		20236*e*
	4925*		4924·1	4923·7‡§			6s		20303*de*
	4907*		4906·1	4906·1‡§			5s		20377*de*
	4892*			4890·1‡§			3s		20443*e*
	4872*			4871·0‡§			4s		20524*e*
				4864·0*§			3s		20553*e*
				4860·2‡§			3s		20569*e*
				4856·2*§			4n		20586*e*
	4853*			4850·0 to 4841·6 ‡			1b		20613 to 20648 *e*
				4750·1*			1s		21046*e*
				4740·9*			1s		21087*e*
			4712·1*	4709·0‡§			6s		21230*e*
	4705*‖		4706 6	4704·6‡§			10s		21245*de*
	4699*		4698·1	4698·5‡§			8s		21278*de*
				4695·5*‡§			1s		21291*e*
	4677*	4674·2	4675·1	4675·4‡§			3s		21384*cde*
				4673·1			1s		21393*e*
	4662*	4660·2	4661·6	4660·7‡§			3s		21449*cde*
	4648*‖	4647·2	4649·1†	4649·3§‡			3s		21506*cde*
				4648·0			9s		21508*e*
		4641·2	4642·1†	4640·6§‡			7s		21539*cde*
	4640*		4640·1	4637·4§‡			6s		21551*de*
				4608·0			2n		21695*e*
				4605·7			1s		21706*e*
	4596*	4595 0	4596·1	4595·1§‡			5s		21754*cde*
	4588*	4589·3	4590·6	4589·9§‡			5s		21780*cde*
	4467*	4466 1		4469·2‡			4n		22383*ce*
				4465·3			3n		22388*e*
		4458·7*‡					3s		22421*e*
				4452·7‡*			2s		22451*e*
				4448·3			2s		22473*e*
				4443·0*‡			1s		22501*e*
	4416*‖	4415·5	4418·1	4416·8§‡			7s		22634*cde*
	4414*	4413·6	4414·1	4414·5§‡			8s		22648*cde*
				4395·6*			1s		22738*e*

OXYGEN—*continued.*

I. Compound Line Spectrum	II. Elementary Line Spectrum				Intensity and Character			Osc. Freq.
Schuster *a*	Huggins	Hartley and Adeney *c*	Thalén *d*	Schuster *e*	I.	II.	III	
4367·6					6s			22809*a*
	4364*	4365·8	4368·1	4366·2§‡		4s		22894*cde*
		4350·5	4350·5	4353·5		4s		22974*cde*
	4347*‖	4348·2	4347·5	4349·0§‡		6s		22991*cde*
			4346·0	4346·9*§		5s		23000*de*
		4343·9		4345·0§		1s		23011*ce*
				4341·4*		1s		23027*e*
		4335·9	4333·0	4336·6*§‡		2s		23058*cde*
	4318*‖‡	4318·7	4319·0	4319·2 *§		3s		23147*cde*
		4316·2	4316·5	4316·5 §		3s		23160*cde*
	4278					5s		23368*b*
	4190*‡	4189·3§	4189·5			5s		23862*cd*
	4183‡	4185·1§	4184·5			1n		23888*cd*
			4155·0*†§			3s		24060*d*
	4149*		4149·0‡§			4s		24095*d*
		4123·7§	4123·0*‡					24245*cd*
	4117*	4119·0§				5s		24271*c*
		4075·1	4075·5‡			6s		24531*cd*
	4073*		4074·0 ‡§					24539*d*
		4071·4§	4071·5			6s		24554*cd*
	4069*	4069·2§	4069·5			6s		24566*cd*

For ultra-violet lines, possibly due to oxygen, see 'Air.'

Plücker gives also oxygen lines of Spectrum I. at 6452, 6118, 5340, 5315, 5144, 4848, 4327, 4262, 4243, 4171, 4136, 4104, and 4094, of which 4243 has also been noted by Lecoq de Boisbaudran.

In the map accompanying the memoir of Ångström and Thalén, oxygen lines are shown at 6170, 5207, 5190, 5175, 5164, 5159, 4964, 4955, 4942, 4940, 4924, 4917, 4890, 4870, 4864, 4859, 4855, 4712, 4706, 4698, 4677, 4663, 4649, 4642, 4640, 4596, 4590, 4468, 4419, 4414, 4368, 4350, 4348, 4346, 4335, 4319, 4316, 4189,4184, 4156, 4149, 4123, 4118, 4076, 4073, 4070.

Vogel gives of Spectrum II. bands at 6450 and 6150.

* Observed also by Plücker. † 4648·9 and 4641·4 Kirchhoff.

‡ Observed also by Salet, who gives also lines at 6450, 6120, 4475.

§ Observed also by Ångström. ‖ Observed also by Lecoq de Boisbaudran.

¶ This band is made up of lines at 5205·0, 5213·3, 5216·9, 5225·3, 5231·2, 5239·0, 5247·7, 5255·0, 5262·7, 5269·5, 5276·9, 5284·4, 5292·5. ** 6171·1 Kirchhoff; 6170 Ångström.

†† This band is made up of lines at 5552·8, 5558·4, 5564·5, 5570·1, 5575·8, 5581·2, 5591·4, 5601·2, 5611·2, 5618·8, 5629·6.

Palladium.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil. Trans.' 1864, p. 139.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Lockyer, 'Phil. Trans.' clxxiii. p. 561, 1881.

Spark Spectrum			Intensity and Character	Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*		
6381			1sc	15667*a*
6248			1sc	16001*a*
*6125	6129·2	6129·4	2sc	16310*bc*
5895			b	16959*a*
5866			3sc	17042*a*
5854			1n	17077*a*
5823			1s	17168*a*
5805			n	17221*a*
5787			n	17275*a*
*5737		5736·4	5sc	17427*c*
5733			1sc	17437*a*
	*5694·1	5693·9	6sd	17557*bc*
*5669	5668·1	5668·8	6sd	17636*bc*
*5653	5651·1		4sd	17690*b*
*5638	5640·1	5642·5	4sd	17721*bc*
*5622	5618·1		6sd	17794*b*
5607			1sc	17829*a*
*5599			4sc	17855*a*
5587			4sc	17894*a*
5564			1sc	17967*a*
*5546	5546·1	5545·4	6sd	18027*bc*
5540	5542·1	5540·3	6sd	18041*bc*
		*5528·7		18082*c*
5512			2nd	18137*a*
5465			2s	18293*a*
*5436			1n	18390*a*
*5394	5394·1	5394·0	8sc	18533*bc*
*5359	5361·6	5361·9	4sd	18649*bc*
*5342	5345·1	5344·1	4sd	18705*bc*
*5310	5312·1	5312·8	4sd	18817*bc*
*5292	5295·1	5293·7	10sc	18882*bc*
*5254	5257·1	5255·7	4sd	19015*bc*
5249			2sc	19045*a*
*5233	5233·7	5234·3	8sc	19100*bc*
*5209	5208·2	5207·8	4sd	19196*bc*
*5163	5163·2	5163·4	10sc	19361*bc*
*5116	5116·6		8sd	19538*b*
*5110	5110·1	5110·7	8sd	19562*bc*
*5062		5062·6	3n	19747*c*
*4876	4874·6	4874·9	6sd	20508*bc*
*4818	4817·1	4821·0	6sd	20745*bc*
	*4787·1	4787·1	6sd	20883*bc*
*4474	4473·6	4473·5	6sd	22347*bc*
	4278·0		2nd	23368*b*
*4212	4212·5		8sc	23732*b*

Lockyer has observed the following lines in the Arc Spectrum of Palladium between the wave-lengths 3900 and 4000:—3991·5, 3984·8, 3957·7.

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Palladium Chloride solution, together with the following lines:—6778, 6177, 5495, 4917, 4170, 4088. † Double.

Phosphorus.

Séguin, 'Compt. Rend.' liii. p. 1272, 1861.
Plücker and Hittorf, Phil. Trans.' clv. p. 24, 1865.
Salet, 'Ann. Chim. Phys.' (4) xxviii. p. 56, 1873.
Christofle and Beilstein, 'Compt. Rend.' lvi. 399, 1863.
Mulder, 'Journ. f. Prakt. Chemie,' xci. p. 111, 1864.
Lecoq de Boisbaudran, Spectres Lumineux,' Paris, 1874.
Lockyer, 'Proc. Roy. Soc.' xxii. p. 374, 1874.
Hofmann, Pogg. Ann cxlvii. p. 92.

I. Band Spectrum		II. Line Spectrum		Intensity and Character		Osc. Freq.
Lecoq de Boisbaudran *a*	Salet *b*	Plücker *c*	Salet *d*	I.	II.	
		6505	6510		6	15360*cd*
		6457	6460		4	15479*cd*
		6433			1	15540*c*
		6370			2	15694*c*
		6200			1	16124*c*
		6173			4	16195*c*
		6100			4	16389*c*
	6090					16415*b*
		6071			4	16467*c*
		6057			10	16505*c*
		6043 }			{ 4 }	
		6032 }	6038		{ 10 }	16558*cd*
			6017			16615*d*
δ5994	5990	6990		5b^r	2	16686*abc*
		5964			2	16762*c*
	5900					16944*b*
	5840					17118*b*
		5601			2	17848*c*
γ5605	5590	5589	5590	8b	2	17885*cd*
		5552 }				
5538		5540 }	5545	3n	2	18027*cd*
	5520					18111*b*
		5500	5505		4	18168*cd*
		5486			2	18223*c*
		5480				18243*c*
	5470			b^r		18276*b*
		5462	5463		4	18301*cd*
		5452			4	18336*c*
5436				3n		18391*a*
		5420	5420		10	18445*cd*
		5402			8	18506*c*
		5381			8	18578*c*
		5358	5365		1	18646*cd*
		5337	5330		8	18744*cd*
		5306			8	18841*c*
		5284	5283		10	18921*cd*
α5263	5250			9b^r		19022*ab*
		5243	5245		10	19063*cd*
		5178				19307*c*
β5106	5110			8b		19571*ab*
5024	5030			3n		19887*ab*
		4972			4	20107*c*
			4935		4	20257*d*
4890	4910			2n		20402*ab*

POTASSIUM—*continued.*

I. Flame Spectrum	II. Spark Spectrum				III. Arc Spectrum	Intensity and Character			Osc. Freq.
Lecoq de Boisbaudran *a*	Lecoq de Boisbaudran *b*	Huggins *c*	Thalén *d*	Kirchhoff *e*	Liveing and Dewar *f*	I.	II.	III.	
	*5112				(5112)		5n	r	19556*b*
5104	η				(5098)	2b			19610*f*
	*5095				(5095)		5n		19621*b*
	5081				(5081)		1n		19675*b*
	5050						2s		19796*b*
	5025						1n		19895*b*
	5002						6s		19986*b*
	4963				(4964)		1n		20143*b*
					4956				20171*f*
4948					4950	2b			20196*f*
	4936				4942		2n		20229*f*
					4870			n	20528*f*
					4863			n	20558*f*
					4856			n	20587*f*
					4850			n	20613*f*
	ζ4828	4827	4827·1				6sd		20710*d*
					4808			n	20797*f*
					4803			n	20814*f*
					4796			n	20845*f*
					4788			n	20880*f*
					4759				21007*f*
	4607						3s		21700*b*
	4505						2s		22191*b*
	4387	4386					3n		22793*b*
	4307	4309	4309·5				4sd		23197*d*
	4262	4263					2s		23456*b*
	4185	4184					4s		23887*b*
					4045				24715*f*
γ4045	*4044	4044			4042	3b	8n	r	24733*f*
					3445·0			8r	29019*f*
					3443·6			8r	29039*f*
					3216·5			7r	31080*f*
					3101·0			6r	32237*f*
					3033·0			5r	32961*f*
					2992·0			4r	33412*f*
					2963·4			3r	33735*f*
					2942·0			2r	33980*f*

Becquerel has observed infra-red lines at 7700, 10980, 11020, and 12330.

* Observed also by Salet.

Rubidium.

Bunsen and Kirchhoff, 'Phil. Mag.' (4) xxii.
Kirchhoff, 'Abh. Berl. Akad.' 1861.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Bunsen, 'Pogg. Ann.' clv. pp. 230, 366; 'Phil. Mag.' (4) l. pp. 417, 527.
Liveing and Dewar, 'Proc. Roy. Soc.' xxviii. pp. 367, 471.

I. Flame Spectrum	II. Spark Spectrum		III. Arc Spectrum	Intensity and Character			Osc. Freq.
Lecoq de Boisbaudran *a*	Thalén *b*	Kirchhoff *c*	Liveing and Dewar *d*	I.	II.	III.	
7951			(7951)	4s			12734*a*
δ7800			(7800)	8s		r	12817*a*
γ6297	6296·7	6297·7		8s	10sc		15875*bc*
ε6203	6204·2	6204·2		6s	8sc		16113*bc*
6159	6160·2	6159·2		4s	6sd		16230*bc*
	6070·2				6sd		16469*b*
6059				2s			16499*a*
ζ 5724				6s			17465*a*
ζ 5650				5s			17694*a*
5429				5s			18414*a*
5359				3s			18654*a*
5259				3s			19009*a*
5194				1s			19247*a*
*5161				3n			19370*a*
5085				1b			19660*a*
5021				1n			19910*a*
	4776·1				4sd		20931*b*
	4569·6				2sd		21877*b*
	4551·1				2sd		21966*b*
β4216			(4216)	9sr			23712*a*
α4202	4202·0		(4202)	10sr	8nc		23791*a*

* Double.

Samarium.

Thalén, 'Öfversigt K. Vetensk. Akad. Förhandl.' xl. No. 7.
Clève, *Ibid.*

Spark Spectrum Thalén	Intensity and Character	Osc. Freq.'	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.
5830·0	2	17147	5643·0	1n	17716	5452·0	5	18336
5802·0	2n	17230	5640·0	2	17725	5421·0	1	18441
5787·0	2	17275	5625·0	2	17772	5415·5	1	18459
5777·0	1	17305	5621·0	1	17785	5410·5	1	18473
5773·0	1	17317	5551·0	4n	18009	5404·5	3	18498
5763·0	1	17347	5515·0	5	18127	5403·0	1	18503
5757·0	1	17365	5511·0	1n	18140	†5367·5	4	18625
5732·0	1	17441	5497·5	2	18185	5348·5	1n	18691
5705·5	2	17522	5493·5	5	18198	†5340·5	4	18719
5695·0	2	17554	5485·0	2	18226	†5320·0	4	18791
5659·0	2	17666	5465·5	4	18291	†5302·0	1	18855

SAMARIUM—*continued.*

Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.
†5282·0	4	18926	†4720·0	1	21180	†4444·0	2n	22496
†5271·0	6	18966	4715·5	2n	21200	4443·5	2	22498
†5251·0	4	19038	4712·5	1	21214	4441·0	2	22511
*5221·0	1	19148	†4703·5	6	21254	†4435·0	1	22541
5200·0	6	19225	4688·0	2	21325	†4433·5	8n	22549
†5174·5	4	19320	4687·0	2	21329	4429·0	2	22572
†5172·5	4	19327	4680·5	1	21359	†4427·0	1	22582
5166·5	1	19350	†4676·5	2	21377	4424·5	8	22595
5161·0	1	19370	†4673·5	4	21391	†4420·5	4n	22615
5157·0	1	19385	4670·0	2	21407	†4418·5	1	22625
†5155·0	2n	19393	†4668·5	4	21414	4416·5	1	22636
5143·0	1	19438	4663·0	1	21439	4411·0	1	22664
†5121·5	4n	19520	4661·0	3	21448	†4408·5	1	22677
†5117·0	6	19537	4655·0	1	21476	4402·0	2	22710
†5104·0	1	19587	4648·5	4	21506	4400·5	1	22718
5103·5	1	19589	4647·3	2	21512	4396·5	1	22739
†5103·0	1	19591	†4646·5	2	21515	4393·0	1	22757
†5100·0	1	19602	4645·0	2	21522	†4390·0	6	22772
5088·5	1n	19646	†4642·0	4	21536	4384·0	1n	22805
5080·0	2	19679	4629·5	2n	21594	4379·5	2	22827
†5071·0	4	19714	4626·5	4	21608	4378·0	2	22835
†5069·0	2	19722	†4615·0	4	21662	4374·5	1	22853
†5052·5	4	19786	4610·5	1	21683	†4373·0	2	22861
5044·0	6	19820	4605·5	2	21707	4370·0	1	22877
†5028·0	3	19883	†4594·5	1	21759	4367·0	1	22892
4975·5	2	20092	†4593·0	4n	21769	†4361·5	2	22921
4971·5	1	20109	†4584·5	3	21806	†4351·5	2	22974
4961·5	2	20149	†4581·0	4	21823	†4350·0	2	22982
4952·5	2	20186	†4577·0	3	21842	†4347·0	4	22998
4949·0	2	20198	4567·0	4	21889	4345·5	2	23005
4946·0	1	20212	†4560·5	2	21921	4336·0	1	23056
4923·0	2	20307	4556·5	1	21940	4334·0	2	23067
4919·0	4	20323	4554·0	2	21952	4329·0	2	23093
4913·0	1	20348	†4552·5	3	21959	4323·0	1	23125
4910·5	4	20358	†4544·0	4	22000	†4318·5	4	23149
4904·0	2	20385	4542·0	1	22010	†4313·0	1n	23179
4883·5	6	20471	4540·5	1	22017	†4309·0	2	23200
4868·0	1	20536	†4537·5	4	22032	4304·5	1	23224
†4847·0	4n	20625	4534·0	1	22049	4296·5	4n	23268
4843·0	2	20642	†4524·0	4	22098	4291·5	1	23295
†4841·0	6n	20651	†4522·5	4	22105	4286·5	1n	23322
4829·0	1	20702	†4519·5	4	22120	4282·0	1	23347
†4815·0	6	20762	4514·5	2	22144	4280·0	4n	23357
4792·0	1	20862	†4511·0	4	22162	4275·0	2	23385
†4790·0	1n	20871	4504·0	1	22196	4271·5	1	23404
4785·0	4	20893	4502·0	2	22206	4262·5	3	23453
4782·5	4	20903	†4498·0	4	22226	4256·5	4	23486
†4777·0	2	20928	4479·5	1	22317	4244·5	1n	23553
†4773·5	2	20943	4477·5	4	22327	4237·0	1n	23594
4770·0	1	20958	†4473·0	1n	22350	4234·5	1n	23608
4759·5	6	21004	†4470·5	2	22362	4229·5	1n	23636
4750·0	1	21047	†4466·5	8	22382	4224·5	2n	23664
†4745·0	4	21069	4457·5	4	22428	4219·5	1n	23692
4728·0	6	21149	†4454·0	6	22445	4204·5	2	23777
†4725·0	1	21158	†4452·5	6	22453	4130·0	1n	24206

* Possibly due to Chlorine.

† These lines occur in Roscoe's 'Terbium' Spectrum, *Journ. Chem. Soc.* xli. p. 283.

Scandium.

Thalén, 'Öfversigt af Kongl. Vetensk Akad. Förhandlingar.' xxxviii. No. 6, p. 13.

Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.
6304·0	10	15858	5665·7	4	17645	5070·0	4	19718
6279 0	2	15919	5656·5	8	17673	5063·5	2	19743
6258·0	2	15975	5640·0	6	17725	5030·5	10	19873
6246·0	6	16006	5590·5	2	17882	4991·0	1	20030
6238·0	6	16026	5564·0	2	17967	4979·5	1	20076
6210·0	8	16098	5526·0	12	18091	4973·0	1	20102
6192·5	2b^{v}	16144	5519·5	6	18112	4953·5	2	20182
6153·0	6b^{v}	16247	5513·5	6	18132	4921·5	1	20313
6145·0	2b^{v}	16269	5484·0	6	18230	4908·5	1	20367
6140·0	4b^{v}	16282	5481·0	6	18240	4838·0	1	20664
6115·0	8b^{v}	16348	5451·0	1	18340	4833·0	1	20685
6100·5	6b^{v}	16387	5445·5	4	18358	4827·0	1	20711
6079·0	10b^{v}	16445	5391·3	6	18546	4753·0	1	21033
6071·5	8b^{v}	16465	5374·5	4	18601	4743·0	6	21079
6064·0	8b^{v}	16486	5355·0	6	18669	4739·5	6	21093
† 6037·0	10b^{v}	16560	5348·5	6	18691	4737·0	4	21104
6016·0	4b^{v}	16617	5341·5	1	18716	4733·2	4	21121
5918·0	2b^{v}	16893	5340 0	1	18721	4728·5	4	21142
5886·5	b^{v}	16983	5339·0	1	18724	4669·5	8	21409
5877·0	b^{v}	17009	5317·5	2	18000	4572·5	1	21863
5848·5	b^{v}	17093	5284·5	4	18918	4556·0	1	21942
5842·0	b^{v}	17112	5257·5	4	19015	4415·0	10	22643
5809·0	b^{v}	17210	5239·0	8	19082	4400·0	10	22721
5801·5	b^{v}	17232	5218·5	2	19157	4385·0	1	22800
5772·0	b^{v}	17320	5210·0	2	19188	4374·0	10	22855
5736·5	b^{v}	17427	5117·0	2	19537	*4354·5	1	22958
5723·5	4	17467	5100·5	1	19600	4324·5	10	23117
5716·0	4	17490	5098·5	4	19608	4320·0	10	23141
5710·5	4	17506	5096·4	1	19616	4314·0	10	23173
5707·5	4	17516	5089·5	1	19643	4306·0	1	23216
5699·5	8	17540	5086·5	5	19654	4295·0	1	23276
5686·0	8	17582	5085·0	4	19660	4248·5	10	23531
5683·2	4	17590	5083·0	5	19668			
5671·0	8	17628	5081·0	6	19675			
5667·5	4	17639	5075·5	1	19697			

* Possibly double.

† Probably due to the Oxide.

Selenium.

Mulder, 'Journ. f. Prakt. Chemie,' xci. p. 113, 1864.
Plücker and Hittorf, 'Phil. Trans.' clv. p. 5, 1865; 'Compt. Rend.' lxxiii. p. 622.
Salet, 'Ann. Chim. Phys.' (4) xxviii. p. 47, 1873.

I. Band Spectrum	II. Spark Spectrum		Intensity and Character	Osc. Freq.	I. Band Spectrum	II. Spark Spectrum		Intensity and Character	Osc. Freq.
Salet *a*	Salet *b*	Plücker and Hittorf *c*	II.		Salet *a*	Salet *b*	Plücker and Hittorf *c*	II.	
		6503	6	15373*c*		5095	5091	10	19629*bc*
		6480	6	15428*c*		ζ	5089	4	19644*c*
		6431	6	15545*c*		5070	5066	6	19726*bc*
		6308	6	15848*c*	5050				19796*a*
		6166	b	16213*c*			5048	2	19804*c*
		6135	b	16295*c*			5029	6	19879*c*
	6070	6070	6	16472*bc*			5014	2	19938*c*
		6035	2	16565*c*			5003	2	19982*c*
		5952	2	16796*c*			5000	2	19994*c*
5870				17031*a*		4995	4994	10	20016*c*
		5856	6	17072*c*		η 4970	4975	10	20105*c*
		5845	2	17104*c*	4950			b	20196*a*
5790				17266*a*	4840	θ4840*	4845	10	20217*c*
		5746	2	17398*c*			4840	10	20655*c*
		5700	2	17539*c*		μ4760	4776	10	20967*bc*
		5683	4	17591*c*	4750				21047*a*
		5668	2	17638*c*		4745	4744	b	21075*bc*
5650				17694*a*		4735	4734	4	21115*bc*
	5630	5628	6	17760*bc*			4707	4	21238*c*
	5600	5596	6	17858*bc*			4700	b	21270*c*
	5570	5566	6	17955*bc*			4675	b	21384*c*
	5530	5524	6	18088*bc*	4670				21407*a*
5500				18177*a*			4663	b	21439*c*
		5461	b	18306*c*		ν4658	4654	10	21471*bc*
		5448	b	18350*c*		4640	4638	8	21550*bc*
		5391	2	18544*c*		4620	4619	8	21643*bc*
		5374	8	18603*c*	4610				21685*a*
5370				18616*a*		π4607	4606	10	21707*bc*
	α5307	5293	10	18862*bc*			4596	4	21752*c*
5270	β 5270	5259	8	18990*bc*			4567	2	21890*c*
	5250	5243	8	19054*bc*			4516	b	22137*c*
		5232	4	19110*c*			4469	b	22370*c*
		5220	4	19152*c*			4447	b	22480*c*
	γ5223	5215	10	19155*bc*			4414	b	22648*c*
5160	δ5177	5162	10	19339*bc*			4402	b	22710*c*
		5153	2	19400*c*			4383	b	22809*c*
	ε5142	5124	10	19510*c*			4349	b	22987*c*
		5115	4	19545*c*			4318	b	23152*c*
		5103	4	19591*c*		4270	4269	b	23415*bc*
		5099	4	19606*c*		4215	4219	b	23706*bc*
						4170	4179	b	23948*bc*
							4138	b	24159*c*

* Double.

Silicon.

Troopt et Hautefeuille, 'Compt. Rend.' lxxiii. p. 620, 1871.
Salet, 'Ann. Chim. Phys.' (4) xxviii. p. 65, 1873.
Plücker, 'Pogg. Ann.' cvii. p. 531, 1859.
Hartley, 'Proc. Roy. Soc.' xxxv. p. 301.
Liveing and Dewar, 'Phil. Trans.' clxxiv. p. 222, 1883.

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Salet *a*	Plücker *b*	Kirchhoff *c*	Liveing and Dewar *d*	I.	II.	
6360	6329			b		15757*ab*
α5981	5978			b		16719*ab*
		5058·1				19764*c*
γ5049	*5043	5043·4		b		19822*c*
δ4420				b		22618*a*
	4205?			b		23774*b*
ε4130	4160?			b		24206*a*
ζ3890		Hartley				25699*a*
		2881·0	2881·1			34699*cd*
		2631·4				37991*c*
		2541·0				39342*c*
		2528·1	2528·1			39543*cd*
		2523·5	2523·9			39612*cd*
		2518·5	2518·8			39691*cd*
		2515·5	2515·8			39739*cd*
		2513·7	2514·1			39766*cd*
		2506·3	2506·6			39884*cd*
		2435·5	2434·8			41052*cd*

* Double.

Silver.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil Trans.' 1864, p. 139.
Mascart, 'Annales de l'Ecole Normale,' iv. 1866.
Thalén, 'Nova Acta Soc. Upsal.' vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874
Lockyer, 'Phil. Trans.' clxiv. p. 805, 1874.
Liveing and Dewar, 'Proc. Roy. Soc.' xxix. p. 398, 1879.
Hartley and Adeney, 'Phil. Trans.' clxxv. p. 109, 1884.

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Liveing and Dewar *d*	I.	II.	
6371				1sc		15691*a*
6249				1sc		15998*a*
6034	6036·2			2nd		16562*b*
5973				1sc		16737*a*
5854				1sc		17077*a*
	5656·1			4nd		17675*b*

I. Spark Spectrum			II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Liveing and Dewar *d*	I.	II.	
5644	5645·1			4nd		17709*b*
5626	5625·6			4nd		17770*b*
5622	5622·6			8nd		17780*b*
5607	5610·6			4nd		17818*b*
5590	5590·1			4nd		17883*b*
5570	5568·1			4nd		17954*b*
	5556·6			2sd		17991*b*
5558	5551·6			8sc		18008*b*
	5522·1			4nd		18104*b*
	5486·6			2nd		18221*b*
5471	5470·1	†5469·9		8sc		18276*bc*
5463	*5464·1	5464·0	(5464·1)	10sc	r	18296*bc*
5426	5423·6			6nd		18432*b*
5412	5411·1			2nd		18475*b*
5401	5401·6			8nc-		18508*b*
	5299·1			6nd		18865*b*
5207	*5208·9	†5208·7	(5208·9)	10sc	r	19193*bc*
	4874·1			8sc		20511*b*
	4666·6			4sd		21422*b*
	*4475·1			4sd		22339*b*
		Hartley and Adeney	§4211·3			23738*d*
			4208			23757*d*
			§4053·0		r	24665*d*
		3541·3		2sd		28229*c*
		3404·2		2sd		29367*c*
		3389·7		2sd		29492*c*
		3382·3		10sc		29557*c*
		‡3351·8		2nd		29826*c*
		3311·6		2sd		30188*c*
		3306·1		2sd		30238*c*
		3300·6		2sd		30288*c*
		3299·0		2sd		30303*c*
		3292·3		2nd		30365*c*
		3288·6		2nd		30408*c*
		3280·1		10sc		30477*c*
		3272·8		2nd		30546*c*
		3265·2		2nd		30617*c*
		3260·2		2nd		30664*c*
		3251·8		2nd		30743*c*
		3243·8		4sd		30819*c*
		3231·8		2nd		30933*c*
		3228·6		2nd		30964*c*
		3222·3		2nd		31024*c*
		3216·0		2nd		31085*c*
		3206·1		2nd		31161*c*
		3198·8		2nd		31252*c*
		3190·6		2nd		31332*c*
		3183·7		2nd		31400*c*
		3179·2		2nd		31445*c*
		3174·3		2nd		31493*c*
		3134·9		1nd		31890*c*

SILVER—*continued.*

Spark Spectrum Hartley and Adeney	Intensity and Character	Osc. Freq.	Spark Spectrum Hartley and Adeney	Intensity and Character	Osc. Freq.
3129·2	1nd	31947	2419·9	7sd	41310
2937·4	2sd	34033	2414·5	1sd	41403
2933·5	5sd	34079	2413·3	9b^{r}d	41423
2928·2	5sd	34140	2411·3	8b^{r}d	41458
2919·1	4sd	34247	2409·3	1sd	41492
2901·6	5sd	34453	2406·4	2sd	41542
2895·6	5sd	34524	2404·5	2sd	41575
2872·7	5sd	34800	2395·7	2sd	41728
2814·5	5sd	35519	2393·3	1sd	41769
2798·9	5sd	35717	2390·8	5sd	41813
¶ 2766·4	7sd	36139	2386·7	2sd	41885
2755·5	7sd	36279	2386·2	2sd	41894
2742·9	2sd	36446	2383·6	2sd	41939
2720·6	1sd	36746	2375·5	6nd	42082
2711·3	7nd	36872	2365·8	4sd	42255
2680·5	6sd	37295	2364·3	5sd	42282
2659·6	7sd	37588	2362·3	5sd	42319
2656·2	4sd	37636	2359·2	5sd	42375
2627·3	4sd	38050	2358·1	7sd	42394
2625·2	4sd	38081	2343·7	1sd	42655
2613·7	4sd	38248	2342·1	1sd	42684
2605·4	4sd	38370	2339·2	1sd	42737
2598·2	1sd	38476	2332·5	1sd	42860
2594·7	2sd	38528	2331·7	9b^{r}d	42872
2579·9	7sd	38749	2325·8	7b^{r}d	42981
2565·8	2nd	38962	2325·3	9b^{r}d	42992
2563·2	2nd	39002	2322·3	4nd	43048
‖2561·5	3sd	39029	2320·6	9b^{r}d	43080
2552·0	1sd	39173	2319·5	2sd	43100
2534·5	7sd	39443	2317·4	9b^{r}d	43139
¶ 2506·0	7sd	39891	2310·1	4sd	43275
2503·6	4sd	39930	2296·8	2sd	43526
2486·4	2sd	40206	2286·7	1sd	43718
¶ 2485·4	2sd	40222	2280·7	9b^{r}d	43833
2479·9	5sd	40311	2277·8	2sd	43888
2476·8	6sd	40362	2275·3	2sd	43937
¶ 2473·3	7b^{r}d	40419	2254·1	4sd	44350
2469·0	2sd	40489	2249·9	7b^{r}d	44433
2462·2	5sd	40601	‖2247·6	7b^{r}d	44478
2459·8	5sd	40640	2230·6	5b^{r}d	44817
2453·0	7sd	40753	2206·0	1sd	45319
2447.4	9sd	40846	2202·0	1sd	45399
‖2445·7	4sd	40875	2186·0	4b^{r}d	45731
2443·9	5sd	40905	2165·8	2sd	46157
2437·3	9nd	41016	2161·3	1sd	46253
2429·8	9sd	41142	2145·4	4b^{r}d	46596
2428;8	4sd	41159	2119·0	1nd	47176
2422·8	2sd	41261	2112·0	1nd	47333

* Observed by Lecoq de Boisbaudran in the Spark Spectrum of Silver Nitrate solution, together with the following:—5022, 4997, 4968, 4669, 4622, 4570, 4518, 4434, 4396, 4208. † 5463·5 and 5207·1, Mascart.
‡ See Tin. § Observed also by Lockyer. ‖ See Lead. ¶ See Copper.

Sodium.

Bunsen and Kirchhoff, 'Phil. Mag.' (4) xx.
Kirchhoff, 'Abh. Berl. Akad.' 1861.
Attfield, 'Phil. Trans.' 1862, p. 221.
Huggins, 'Phil. Trans.' 1864, p. 139.
Rutherford, 'Sillman's Journal' (2) xxxv. p. 407.
Wolf and Diacon, 'Compt. Rend.' lv. p. 334.
Müller, 'Pogg. Ann.' cxviii. p. 641.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Lockyer, 'Proc. Roy. Soc.' xxix. p. 140, 1879.
Cornu, 'Spectre Normal du Soleil,' Paris, 1881.
Bunsen, 'Pogg. Ann.' clv. p. 366; 'Phil. Mag.' (4) l. p. 527.
Liveing and Dewar, 'Proc. Roy. Soc.' xxviii. pp. 367, 471; xxix. pp. 398, 402, 1879.
Becquerel, 'Compt. Rend.' xcvi. p. 1218; xcvii. p. 72.

I. Spark Spectrum		II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Thalén *c*	Liveing and Dewar *d*	I.	II.	
†6155(3)	* 6160·2		(6160·2)	8sc		16228*b*
†6149(3)	* 6154·4	6154·2	(6154·4)	8sc		16244*b*
D_1 †5895(4)	* 5895·1	5895·0	(5895·1)	10sc	10r	16958*b*
D_2 †5889(4)	* 5889·1	5889·0	(5889·1)	10sc	10r	16976*b*
†5687(3)	* 5687·3	5687·3	(5687·3)	6sd	r	17578*b*
†5681(3)	* 5681·5	5681·4	(5681·5)	6sd	r	17596*b*
		5674·4	* 5673·6		r	17619*cd*
		5668·0	* 5668·6		r	17637*cd*
†5154(1)	* 5155·0		(5155·0)	6sd	s	19393*b*
†5159(1)	* 5152·7		(5152·7)	6sd	s	19402*b*
†4985(1)	* 4983·3		4983	4nc	nr	20061*b*
	4982·0		4982		nr	20066*d*
			4980·5		n	20072*d*
			* 4751·4		s	21040*d*
			4747·5		s	21057*d*
			* 4667·5		nr	21418*d*
			4663·7		nr	21436*d*
			4543·6		s	22002*d*
			4540·7		s	22016*d*
			4496·4		n	22234*d*
			4494·5		n	22243*d*
			4423·0		s	22602*d*
			4419·5		s	22620*d*
			4393		b	22757*d*
			4390		b	22772*d*
			4343		b	23019*d*
		Cornu	4325		b	23114*d*
		3301·2				30284*c*
		3300·8				30286*c*

Becquerel has observed i fra-red lines at 8190 ‡ and 11420 in the Arc Spectrum of Sodium.

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Sodium Sulphate.
† Observed by Lockyer. The 'indices' attached to these numbers denote the comparative 'lengths' of the lines.
‡ 8199 Abney.

Strontium.

Bunsen and Kirchhoff, 'Phil. Mag.' (4) xx.
Kirchhoff, 'Abh. Berl. Akad.' 1861.
Müller, 'Pogg. Ann.' cxviii. p. 641.
Huggins, 'Phil. Trans.' 1864, p. 139.
Mascart, 'Annales de l'Ecole Normale.' iv. 1866.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lockyer, 'Phil. Trans.' clxiii. p. 639; clxiv. p. 311.
Liveing and Dewar, 'Phil. Trans.' clxxiv. p. 217.
Becquerel, 'Compt. Rend.' xcvi. p. 1218; xcvii. p. 72.

I. Spark Spectrum			II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Lockyer *d*	Liveing and Dewar *e*	I.	II.	
7108					4s		14065*a*
6885					4s		14520*a*
6790					4s		14723*a*
6641					1s		15054*a*
6606					2s		15133*a*
*6548	†6550·3(2)				4sd		15262*b*
6502	†6501·8(2)	6502·7			8sd		15375*bc*
6435					b		15535*a*
6410	†6407·3(1)	6407·4			10sc		15602*bc*
6388	†6387·3(2)				6sd		15651*b*
6383	†6380·3(2)				4sd		15669*b*
6369					1s		15696*a*
6347					1s		15751*a*
6343					1s		15761*a*
6311					b		15841*a*
6274					1s		15934*a*
6251					b		15992*a*
6220					b		16075*a*
6172					1s		16199*a*
6098					2s		16394*a*
5998					b		16667*a*
5977					b		16726*a*
5971	†5970·7(2)				2sd		16743*b*
	†5850·1(2)				2sd		16802*b*
5816					1s		17189*a*
5766					1n		17338*a*
5647					2n		17703*a*
5623					3s		17779*a*
5579					1s		17919*a*
5543					4s		18036*a*
*5540	†5540·1(2)	5539·4			6sd		18046*bc*
5531	†5533·0(2)	5533·6			8sc		18067*bc*
*5519	†5522·6(2)	5520·6		(5522·6)	8sc	r	18105*bc*
*5500	†5503·6(2)	5503·0		(5503·6)	8sc	r	18166*bc*
5496					b		18190*a*
5487	†5485·1(1)	5484·8			6sd		18226*bc*
*5480	†5480·1(2)	5480·8		(5480·1)	10sc	r	18241*bc*
*5450					5s		18343*a*
5423					2s		18435*a*
5383					3b		18571*a*
*5254	†5256·1(1)	5256·6		(5256·1)	8sc	r	19019*bc*
*5238	†5238·7(1)	5238·1		(5238·1)	10sc	r	19084*bc*
*5228	†5228·7(1)	5228·3		(5228·7)	6sd	r	19120*bc*
5224	†5225·7(1)	5225·4		(5225·7)	6sd		19131*bc*

STRONTIUM—*continued.*

I. Spark Spectrum			II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Lockyer *d*	Liveing and Dewar *e*	I.	II.	
5221	†5223·7(1)	5222·8		(5223·7)	6sd	r	19138*bc*
5217					2s		19162*a*
*5155				(5155·0)	2s	r	19393*a*
5102					1		19594*a*
*4967	†4967·6(1)				4sd		20124*b*
4962	†4961·6(1)			(4961·6)	8sc	r	20149*b*
4943					1b		20224*a*
*4893				(4893·0)	1s	r	20431*a*
*4875	†4876·1(1)			(4876·1)	6sd	r	20502*b*
4872	†4872·1(1)			(4872·1)	6sd	r	20519*b*
4865				(4865·0)	2	r	20549*a*
4853					2		20600*a*
*4830	†4831·6(1)			(4831·6)	6sd	r	20691*b*
*4811	†4812·1(1)			(4812·1)	6sd	r	20775*b*
*4784	†4783·6(1)			(4784)	6sd		20899*b*
4750					1s		21046*a*
4742	†4740·6(1)			(4741)	6sd		21088*b*
*4721	†4721·1(1)			(4721)	6sd		21175*b*
*4604	†4607·6(4)	4607·4		(4607·6)	10nc	r	21697*bc*
4438			4437·0(1)		2n		22531*d*
4367			4365·0(2)		1s		22903*d*
4361					1n		22924*a*
4337			4336·0(3)		2n		23056*d*
4319			‡‖4325·0(3)		2n		23114*d*
*4305	†4305·3(2)	4304·9	4305·3(4)	(4305·3)	10nc	r	23221*bcd*
	§†4226·3(3)				6nd		23654*b*
*4215	†4215·3(3)		4215·3(5)	(4215·3)	10nc	r	23716*bd*
*4161	†4161·0(2)		4161·0(3)		6nc		24026*d*
*4078	†4078·5(4)		4077·0(5)	(4078·5)	10nc	r	24516*bd*
			¶4031·7(2)				24796*d*
			‖4031·5(2)				24797*d*
			4029·4(4)				24810*d*
			3969·1				25187*d*
			3939·5(				25376*d*
				§3705·0			26983*d*
				3653·0			27367*d*
				3547·0			28184*d*
				3527·0			28344*d*
				3498·0			28579*d*
				3464·0			28859*d*
				3458·0		n	28910*d*
				3379·5			29581*d*
				3364·5			29713*d*
				3305·2			30246*d*
				2931·1			34106*d*

Becquerel has observed infra-red lines at 8700, 9610, 10030, 10340, and 10980 in the Arc Spectrum of Strontium.

* Observed by Lecoq de Boisbaudran, together with the bands of Strontium Oxide, in the Spark Spectrum of solution of Strontium Chloride.

† Observed also by Lockyer: the 'indices' attached to these numbers denote the comparative 'lengths' of the lines. ‡ See Barium. § See Calcium. ‖ See Iron. ¶ See Manganese.

SULPHUR—*continued.*

I. Band Spectrum	II. Line Spectrum				Intensity and Character		Oscillation Freq.	
Salet *a*	Ångström *b*	Hasselberg *c*	Plücker and Hittorf *d*	Salet *e*	I.	II.	I.	II.
4450					2b		22465*a*	
			4432	4435		b		22549*de*
			4422	4425		b		22600*de*
4367			4386	4390	3b	b	22892*a*	22783*de*
			4358			4		22940*d*
			4350			4		22982*d*
			4343			4		23019*d*
			4336			4		23056*d*
			4329			4		23093*d*
4320					2b		23141*a*	
			4315	4315		b		23168*de*
			4297	4295		8		23270*de*
			4284	4282		8		23340*de*
			4279			4		23362*d*
			4272	π 4269		8		23409*de*
			4259			4		23473*d*
			4255	4250		8		23508*de*
			4241			b		23572*d*
			4229			b		23639*d*
			4196	4192		b		23836*de*
4187					2b		23876*a*	
			4181	4180		6		23914*de*
			4168	ρ 4162		8		24003*de*
			4158	4155		6		24052*de*
			4140			6		24148*d*
4070					2b	2½	24563*a*	

TANTALUM.

Lockyer, 'Phil. Trans.' clxxiii. p. 561, 188.

Arc Spectrum Lockyer	Intensity and Character	Oscillation Frequency	Arc Spectrum Lockyer	Intensity and Character	Oscillation Frequency
3998·6		25001	3971·2		25174
3995·7		25019	3964·5		25216
3995·0		25024	3963·3		25224
3991·0		25049	3942·7		25356
3987·4		25071	3940·3		25371
3979·7		25120	3936·3		25397
3975·5		25146	3914·0		25541
3973·0		25162	3911·0		25561
3971·6		25171	3906·9		25588

I. Band Spectrum	II. Line Spectrum				
Salet *a*	Ångström *b*	Hasselberg *c*	Plücker and Hittorf *d*	Salet *e*	
		5217·8	5218		
5250	5207		5207	5220	
	5191	5214·4	5199	5217 5205	
5190			5191		
		5200·1	5182	5160	
5143		5142·5	5143		
			5141		
			5140		
			5124		
			5110		
5088		5102·9	5096	5103	
		5078·3	5068		
5040		5044·9	5044		
			5036		
	5027	5032·5	5030	5030	
			5024	5024	
	5013	5012·7	5013	5013	
			5004	ϵ 5008	
			5003		
4990	4994	4993·9	5000	5000	
4945			4990	4990	
		4941·5	4942		
	4926	4925·0	4924	ζ4925	
		4918·5	4922		
		4901·9	4902		
4890		4884·5	4884		
4840					
			4825	4825	
		4815·6	4813	η4810	
		4808·5	4804		
4795		4792·8	4791		
		4778·5	4777		
		4762·8	4768		
		4752·8	4762		
4755					
			4734		
			4723		
		4714·9	4718	θ4715	
4705					
			4692	4690	
			4671	4670	
4655			4657	4655	
			4630	4630	
4615			4610	4610	
			4593	4590	
			4580	4580	
			4561	4560	
		4551·5	4552	4556	
4540					
		4524·7	4523	4525	
		4485·1	4485	μ 4485	
4470					
		4464·0	4466	4467	

Tellurium.

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Gernez, 'C. R.' lxxiv. p. 1190 (1872).
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Hartley and Adeney, 'Phil. Trans.' clxxv. p. 63 (1883).

I. Band Spectrum	II. Line Spectrum			Intensity and Character		Oscillation Frequency	
Salet *a*	Salet *b*	Huggins *c*	Thalén *d*	I.	II.	I.	II.
		6645			4		15044*c*
	(6437)	6431	6437·2		10s		15531*d*
		6366			1s		15704*c*
		6347			1n		15751*c*
		6290			2s		15893*c*
6250		6243		5b	3n	15995*a*	16013*c*
		6228			3s		16052*c*
6150				5b		16255*a*	
6050	(6046)	6042	6046 2	5b	6sd	16524*a*	16534*d*
	(6012)	6010	6012·7		6sd		16626*d*
		5995			1n		16676*c*
	(5973)	5970	5973·2		10sc		16736*d*
5940	(5935)	5934	5935·2	5b	8sc	16830*a*	16844*d*
	(5856)	5854	5856 6		4sd		17069*d*
5855	(5852)	5849	5852·1	7b	4sd	17074*a*	17083*d*
	(5825)		5825·1		4nd		17162*d*
	(5805)		5805 6		4nd		17220*d*
			5781·1		6sd		17293*d*
	(5755)	5756	5755·1		10sc		17371*d*
		5740	5741·1		2sd		17413*d*
5735				8b[v]		17432*a*	
	(5707)	5708	5706·6		10sc		17518*d*
5685				8b		17585*a*	
	(5647)	5646	5647·1		10sc		17703*d*
		5618	5616·1		4sd		17801*d*
	(5574)	5575	5574·1		8sc		17935*d*
5560				4b		17980*a*	
	(5488)	5486	5488·1		6sd		18022*d*
5470	(5477)	5476	5477·6	4b	6sd	18276*a*	18251*d*
	(5447)	5447	5447·6		8sc		18351*d*
5410		5409	5408·6	4b	4sd	18479*a*	18483*d*
	(5366)	5366	5366·1		6sc		18630*d*
5340				4b		18721*a*	
	(5310)	5309	5310·1		6sd		18826*d*
		5298	5299·1		2sd		18865*d*
5278				4b		18941*a*	
5220	(5217)	5222	5217·2	4b	8nc		19162*d*
			5172·2		2sd		19328*d*
5156	(5152)		5152·2	4b	6sd	19389*a*	19403*d*
		5134	5133·2		2nd		19475*d*
	(5104)		5104·1		6sd		19586*d*
5070				4b		19718*a*	
		5038	5035·1		4sd		19855*d*
5015				4b		19934*a*	
4970				4b		20115*a*	
4920				4b		20319*a*	

TELLURIUM—*continued.*

I. Band Spectrum	II. Line Spectrum			Intensity and Character		Oscillation Frequency	
Salet *a*	Salet *b*	Huggins *c*	Thalén *d*	I.	II.	I.	II.
			4895·1		2nd		20422*d*
4870	(4866)	4866	4866·6	4b	4nd	20528*a*	20542*d*
		4832	4832·1		2nd		20689*d*
4820				4b		20741*a*	
	Hartley	4785	4785·1		2nd		20892*d*
4767	and			8b		20971*a*	
4725	Adeney			8b		21158*a*	
	4707·5	4709			4sd		21236*b*
	4693·0				4sd		21302*b*
4670				8b		21407	
		4664			1n		21434*c*
		4652			1n		21490*c*
4600	4602·0	4602	4603·6	6b	2sd	21733*a*	21719*bd*
		4599			1n		21738*c*
4560				6b		21923*a*	
		4544			b		22000*c*
4510				6b		22166*a*	
	4487·0				2sd		22280*b*
	4480·0	4479			2sd		22315*b*
4470				4b		22365*a*	
	4436·0				2sd		22536*b*
4400	4400·0			4b	2sd	22721*a*	22721*b*
	4378·0				2sd		22835*b*
	4364·5				2sd		22905*b*
4350	4353·0	4352		2b	2sd	22982*a*	22966*b*
4330	4324·6			2b	4sd	23088*a*	23117*b*
	4301·5	4302			6sd		23241*b*
4280	4292·7			2b	4sd		23288*b*
	4287 3				4sd	23358*a*	23318*b*
	4274·4				6sd		23388*b*
	4259·8	4259			6sd		23468*b*
4250				2b		23522*a*	
	4221·1				6sd		23684*b*
4200				2b		23802*a*	
	4180·7				2sd		23912*b*
	4170·3				4sd		23972*b*
4150				2b		24089*a*	
	4119·7				4sd		24267*b*
	4072·7				2sd		24546*b*
	4061·3	4063			6sd		24615*b*
	4054·2				6sd		24658*b*
	4048·3				4sd		24694*b*
	4006·0				8sd		24955*b*
	3983·8				6sd		25094*b*
	3968·6				6sd		25190*b*
	3948·0				6sd		25322*b*
	3932·5				2sd		25421*b*
	3908·7				2nd		25576*b*
	3841·3				8sd		26025*b*
	3803·0				4sd		26286*b*
	3796·9				2sd		26330*b*
	3789·0				4sd		26385*b*
	3776·0				4sd		26478*b*
	3771·0				4sd		26513*b*

TELLURIUM—*continued.*

Line Spectrum Hartley and Adeney	Intensity and Character	Oscillation Frequency	Line Spectrum Hartley and Adeney	Intensity and Character	Oscillation Frequency
3765·0	4sd	26553	3217·6	4sd	31069
3759·0	4sd	26595	3213·3	4sd	31111
3754·0	4sd	26630	3210·4	2sd	31139
3735·5	8sd	26762	3192·2	4sc	31317
3726·2	8sd	26829	3188·1	4sc	31356
3716·0	4sd	26903	3183·7	2sd	31400
3698·7	4sd	27028	3174·4	4sc	31492
3683·3	4sd	27141	3168·5	4sd	31551
3676·7	4sd	27190	3158·4	2sd	31652
3670·4	4sd	27237	3154·1	4sd	31695
3656·4	4sd	27341	3145·7	4sd	31779
3649·2	6sd	27396	3131·7	2sd	31921
3644·3	6sd	27433	3124·7	2sd	31993
3636·3	4sd	27492	3119·5	4nd	32046
3626·7	4sd	27565	3107·5	6sd	32170
3617·0	6sd	27639	3098·7	4sd	32261
3611·0	4sd	27685	3095·5	4sd	32294
3601·7	4sd	27756	3088·0	4sd	32374
3599·6	4sd	27772	3072·7	6sd	32535
3594·5	4sd	27812	3063·2	2sd	32636
3589·4	4sd	27851	3052 8	2sd	32747
3551·6	8sd	28148	3046·0	8nc	32820
3541·8	4sd	28225	3022·1	2sc	33080
3533·1	4sd	28295	3016·6	8sd	33140
3520·3	8sd	28398	3012·1	4sd	33190
3510·8	2sd	28475	3004·1	4sd	33278
3496·3	8sd	28593	2996·4	4sd	33363
3483·7	2sd	28696	2988·8	4sd	33448
3480·8	4sd	28720	2976·2	4sd	33590
3474·4	2sd	28763	2975·5	4sd	33601
3465·5	4sd	28847	2973·1	2sd	33625
3456·0	8sd	28927	2966·1	8sd	33704
3450·4	2sd	28982	2960·3	2sc	33770
3441·2	8sd	29051	2956·3	2sd	33816
3422·2	4sd	29212	2950·6	2sd	33881
3415·3	4sd	29271	2948·8	2sd	33900
3407·5	8sd	29338	2945·3	2sd	33942
3382·4	10sc	29556	2940·8	8sd	33994
3374·1	4sd	29629	2937·7	4sd	34030
3362·4	8sd	29732	2932 5	4sd	34090
3352·1	6sd	29824	2928·1	2sd	34141
3329·0	6sd	30030	2923·4	4sd	34196
3322·7	4sd	30087	2918·9	2sd	34249
3315·8	4sd	30149	2905·9	2sd	34402
3307·1	8sc	30229	2901·9	4sd	34449
3289·6	2sc	30390	2894·3	8nd	34540
3280·0	10sc	30479	2893·3	6sd	34552
3273·4	10sc	30540	2877·4	2sd	34743
3267·4	2sd	30596	2873·6	2sd	34789
3264·6	2sd	30622	2867·7	8nd	34860
3256·3	8sd	30700	2859·9	6sd	34954
3250·8	4sd	30751	2857·0	8nd	34991
3246·8	10sc	30790	2844·9	6sd	35139
3242·1	4sd	30835	2840·0	6sd	35200
3234·2	4sd	30910	2836·9	2sd	35226
3229·4	2sd	30953	2834·4	2sd	35270
3221·8	4sd	31029	2823·2	6sc	35409

TELLURIUM—*continued.*

Line Spectrum Hartley and Adeney	Intensity and Character	Oscillation Frequency
2815·3	2sd	35509
2813·0	2sd	35538
2799·1	4sd	35714
2795·5	4sd	35760
2791·9	8nd	35807
2768·6	6sc	36108
2766·5	6sd	36135
2766·0	4sc	36142
2756·0	2sc	36273
2751·5	2nd	36332
2745·0	4sd	36418
2743·0	4sd	36444
2739·5	4sd	36491
2738·0	4sd	36511
2723·2	2nd	36711
2720·7	2sd	36744
2718·0	2sd	36781
2713·0	2sd	36848
2710·2	8nd	36887
2702·3	2sd	36995
2700·3	2sd	37022
2696·6	6nd	37073
2694·1	6nd	37107
2690·2	2sd	37161
2688·2	2sd	37189
2683·2	2nd	37258
2679·8	2nd	37305
2674·6	2sc	37378
2666·0	4sd	37498
2659·4	2bvd	37591
2657·1	4nd	37624
2648·7	2nd	37743
2647·0	2nd	37767
2642·3	2nd	37834
2637·0	2sd	37910
2634·7	6nd	37943
2630·5	2nd	38004
2627·8	4sd	38043
2624·3	4sd	38094
2621·4	4sd	38136
2617·4	2sc	38195
2613·7	4sd	38248
2611·3	4sd	38283
2604·4	2nd	38385
2599·4	2sd	38459
2598·1	2sd	38478
2594·0	2sd	38538
2590·1	2nd	38597
2585·0	2nd	38673
2580·1	2nd	38746
2578·0	2nd	38778
2574·8	4sd	38823
2572·4	4nd	38865
2567·8	2nd	38932
2564·1	2nd	38988
2558·7	2nd	39070
2549·7	2nd	39275
2543·7	6sd	39300
2536·8	2nd	39407
2533·8	2sd	39454
2529·4	8sc	39523
2528·3	2nc	39540
2525·6	2sd	39582
2505·2	6sd	39904
2502·7	2sd	39944
2498·6	6nd	40010
2491·3	2sc	40127
2490·8	2nd	40134
2488·7	2sd	40168
2485·3	2nd	40224
2480·9	2sd	40295
2479·6	2nd	40316
2476·7	2nd	40363
2473·2	6sd	40420
2469·0	2nd	40489
2462·0	4nd	40604
2460·2	4nd	40634
2452·8	2nd	40756
2447·8	6sd	40840
2444·3	2nd	40906
2441·7	2sc	40942
2438·0	8sc	41004
2432·0	2nc	41105
2429·7	2nd	41144
2428·2	2sc	41169
2426·7	2nd	41195
2425·0	4nd	41224
2420·3	2nd	41304
2418·5	2nd	41334
2413·3	8sc	41423
2411·4	6sc	41456
2403·7	6nd	41589
2400·0	6sc	41653
2392·8	4nd	41778
2390·7	4nd	41815
2386·3	10nc	41892
2383·8	10nc	41936
2377·0	2nd	42056
2375·3	2nd	42086
2370·3	8sc	42175
2364·7	4nd	42274
2362·8	4nd	42310
2359·8	4nd	42364
2358·6	6sd	42385
2357·0	4nd	42414
2351·7	8nd	42510
2344·3		
2340·3		
2336·8		

TELLURIUM—*continued*.

Line Spectrum Hartley and Adeney	Intensity and Character	Oscillation Frequency	Line Spectrum Hartley and Adeney	Intensity and Character	Oscillation Frequency
2332·0	8sd	42869	2202·8	2nd	45382
2325·5	8sd	42989	2200·1	2nd	45438
2321·0	8sd	43072	2196·5	2nd	45513
2317·8	8sd	43131	2192·2	6nc	45602
2310·1	2nd	43275	2189·7	6nd	45654
2303·7	2nd	43408	2186·9	2nd	45712
2301·1	2nd	43444	2182·0	2nd	45815
2297·5	2nd	43512	2179·2	6nc	45874
2295·0	6nc	43560	2175·3	2nd	45954
2291·8	2nd	43620	2167·2	2nd	46128
2288·6	2nd	43673	2165·7	2nd	46160
2280·6	6nd	43831	2159·7	2nd	46288
2277·2	6nd	43900	2149·7	2nd	46503
2285·7	6nd	43756	2147·8	2nc	46544
2266·2	6nc	44113	2146·7	2nd	46568
2264·2	2nd	44152	2142·7	2nd	46653
2260·4	6nc	44230	2136·5	2nd	46790
2256·6	6nc	44301	2135·0	2nd	46823
2250·0	6nd	44431	2125·5	2nd	47032
2248·0	6sc	44470	2122·5	2nd	47099
2247·3	6nc	44484	2119·0	2nd	47176
2243·3	6b^{r}c	44563	2116·3	2nd	47237
2240·7	2nd	44615	2113·3	2nd	47304
2231·3	2nc	44803	2110·5	2nd	47366
2230·3	2nc	44823	2108·4	2nd	47414
2229·0	2nc	44849	2103·6	2nd	47522
2226·8	2nd	44893	2100·2	2nd	47600
2223·2	2nd	44966	2078·5	2nd	48095
2219·3	6b^{r}c	45045	2050·8	2nd	48745
2216·0	2nc	45122	2039·2	2nd	49022
2211·2	6nd	45210	2032·7	2nd	49179
2209·5	6nd	45245			

TERBIUM.

Roscoe and Schuster, 'Journ. Chem. Soc.' xli. p. 283.

Spark Spectrum Roscoe and Schuster	Intensity and Character	Oscillation Frequency	Spark Spectrum Roscoe and Schuster	Intensity and Character	Oscillation Frequency
5371·4	6	18612	5347·7	5	18694
5369·4	4	18619	5342·3	6	18713
5368·3	4	18623	5340·0	5	18721
5367·2	6d	18626	5331·4 ?	2n	18751
5360·3	4	18650	5320·5	7	18790
5352·1	5	18679	5318·7	7	18796
5349·6	7	18689	5306·4	7	18839

TERBIUM —*continued*.

Spark Spectrum Roscoe and Schuster	Intensity and Character	Oscillation Frequency	Spark Spectrum Roscoe and Schuster	Intensity and Character	Oscillation Frequency
5301·6	7	18857	4951·7	5	20189
5300·6	7	18860	4947·6	6	20206
5292·3	3	18890	4937·1	4	20249
5281·6	6	18928	4935·5	4	20255
5280·4	6	18932	4933·1	2	20265
5271·9	3	18963	4911·9	2	20353
5270·6	7	18968	4909·0	3	20364
5268·8	6	18974	4893·2	2	20430
5264·5 ?	2	18989	4864·2	2	20552
5261·4 ?	6	19001	4847·0	5	20625
5254·8	5	19024	4843·7	2	20639
5251·1	7	19038	4841·2	2	20650
5250·1	5	19041	4821·1	3	20732
5248·6	4	19047	4815·0	7	20762
5236·7	3	19096	4799·8	4	20828
5233·3	4	19103	4790·2	4	20870
5232·0	3	19108	4781·9	2	20906
5218·7	5	19156	4776·7	3	20928
5197·1	6	19236	4773·6	2	20942
5195·1	3	19243	4766·1	3	20975
5192·0	6	19255	4757·6	2	21013
5190·3	6	19261	4754·5	2	21026
5185·8	6	19278	5744·8	6	21070
5182·8	5	19289	4743·0	3	21078
5175·4	7	19317	4725·4	2	21156
5174·6	7	19320	4720·0	2	21180
5172·3	7	19328	4717·0	2	21194
5165·6	3	19353	4715·0	2	21203
5155·2	5	19392	4712·0	4	21216
5154·4	4	19395	4703·5	6	21254
5140·5	2	19448	4700·2	6	21269
5129·8	4	19488	4686·5	4	21332
5124·9	2n	19507	4676·1	5	21379
5121·5	3	19520	*4673·6	5	21390
5116·5	4	19539	4668·6	6	21413
5111·8	1	19557	4654·5	3	21478
5108·5	4	19569	4646·4	2	21515
5104·2	3	19586	4641·6	5	21538
5102·9	5	19591	4638·0	3	21557
5100·1	7	19603	4635·9	2	21564
5097·8	4	19611	4614·9	5	21662
5091·9	5	19633	4603·5	2	21716
5073·9	4	19703	4600·3	4	21731
5070·7	6	19715	4597·3	2	21745
5069·2	6	19721	4596·3	2	21750
5066·5	3	19732	4594·3	3	21759
5060·6	2	19755	4593·0	3	21766
5057·2	4	19768	4590·8	2	21776
5052·3	8	19787	4589·0	2	21785
5050·9	2	19793	4584·1	4	21808
5030·4	6	19873	4581·7	4	21819
5027·9	6	19883	4580·5	2	21825
5014·6	6	19936	4576·9	5	21842
4960·9	6	20152	4565·7	5	21896
4956·6	5	20169	4560·3	2	21921

TERBIUM—*continued.*

Spark Spectrum Roscoe and Schuster	Intensity and Character	Oscillation Frequency	Spark Spectrum Roscoe and Schuster	Intensity and Character	Oscillation Frequency
4557·6	2	21939	4430·1	2	22566
4553·5	3	21954	4427·3	2	22580
4552·4	3	21960	4423·8	8	22598
4543·6	5	22002	4420·6	3	22615
4541·3	4	22013	4420·3	3	22616
4539·3	5	22023	4418·7	3	22624
4537·2	6	22034	4414·3	4	22647
4523·6	5	22051	4408·9	3	22675
4522·7	4	22104	4407·7	3	22681
4521·9	2	22108	4406·3	4	22688
4519·2	5	22121	4402·7	6	22707
4511·5	4	22159	4401·4	6	22713
4498·7	4	22222	4390·4	5	22770
4497·6	3	22228	4387·1	2	22787
4496·9	4	22231	4382·4	2	22812
4483·9	2	22296	4380·1	2	22824
4482·8	3	22301	4373·4	3	22859
4480·6	3	22312	4369·2	5	22882
4475·9	2	22336	4361·4	4	22922
†4473·4	2	22348	4360·4	5	22927
4472·2	4	22354	4351·6	6	22973
4470·9	3	22360	4350·2	6	22980
4466·9	7	22380	4347·1	6	22996
4466·1	2	22384	4346·0	4	23003
4462·6	2	22402	4341·7	8	23026
4458·3	5	22424	4335·5	6	23058
4454·3	6	22444	4333·4	3	23070
4452·6	6	22452	4329·8	2	23089
4449·6	2	22467	4328·4	4	23096
4444·0	4	22496	4326·1	3	23109
4441·8	2	22507	4325·0	4	23114
4437·8	3	22527	4318·4	5	23150
4435·6	4	22538	†4315·3	2	23166
4435·1	4b	22541	†4313·1	2	23178
4433·7	7	22548	4308·7	5	23202

* Less refrangible than the Yttrium line 4673·8. † Double.

Thallium.

Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Bunsen, 'Pogg. Ann.' clv. p. 366; 'Phil. Mag.' l. p. 527.
Huggins, 'Phil. Trans.' cliv. p. 139, 1864.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Schönn, 'Ann. Phys. u. Chem.' N.F. ix. 483; x. 143.
Liveing and Dewar, 'Phil. Trans.' clxxiv. p. 219, 1883.
Hartley and Adeney, 'Phil. Trans.' clxxv. p. 104, 1884.

Flame Spectrum	II. Spark Spectrum		III. Arc Spectrum	Intensity and Character			Osc. Freq.
Lecoq de Boisbaudran *a*	Huggins *b*	Thalén *c*	Liveing and Dewar *d*	I.	II.	III.	
	6547				4s		15270*b*
	6240				1n		16021*b*
	6002				2s		16656*b*
	5949	5947·7			6nc		16808*c*
	5824				2s		17165*b*
	5771				1n		17323*b*
5680				3n			17600*a*
		5608·1			2sd		17826*c*
	5487	5490·1			2sd		18209*c*
		5412·6			4nd		18470*c*
		5360·1			4sd		18651*c*
5349	5347	5349·6	(5349·6)	10sc	10nc	r	18687*c*
	5153	5152·7			8nc		19405*c*
		5085·1			4sd		19660*c*
	5078	5078·6			6nd		19685*c*
	5054	5053·1			6sd		19784*c*
	4980	4981·6			6nd		20068*c*
		4945·6			4sd		20214*c*
	4893	4892·1			4sd		20435*c*
	4767				2n		20971*b*
	4737	†4735·6			6nd		21110*c*
		Hartley and Adeney					
		4270·5			4d		23410*c*
		4152·7			2d		24074*c*
	4112	4109·4			8d		24327*c*
		4057·2			2sd		24642*c*
		4009·2			2d		24935*c*
		3932·7			8d		25420*c*
		3790·0			2d		26378*c*
		3775·6	3775·6		10sc		26478*cd*
		3682·2			2d		27149*c*
		3674·6			2d		27206*c*
		3658·9			4d		27322*c*
		3652·9			4d		27367*c*
		3528·8	3528·3		10sc		28331*cd*
		3518·6	3517·8		10sc		28415*cd*
		3512·7			2d		28459*c*
		3507·8			2d		28499*c*
		3455·8			8d		28928*c*
		3381·3			8sd		29566*c*
		3369·1			2d		29673*c*
		3347·4			2d		29866*c*
		3299·6			4d		30297*c*

THALLIUM—*continued.*

I. Flame Spectrum	II. Spark Spectrum		III. Arc Spectrum	Intensity and Character			Osc. Freq.
Lecoq de Boisbaudran *a*	Huggins *b*	Thalén *c*	Liveing and Dewar *d*	I.	II.	III.	
		3293·6			4d		30353*c*
		3288·6			2d		30399*c*
		3271·6			4d		30557*c*
		3246·6			4sd		30792*c*
		3229·0	3228·1		8sc		30964*cd*
		3214·2			2d		31102*c*
		3195·6			4d		31283*c*
		3186·6			4nd		31372*c*
		3162·6			8d		31610*c*
		3146·7			4d		31769*c*
		3119·4			4d		32055*c*
		3111·4			4d		32130*c*
		3105·7			4d		32188*c*
		3091·0			10sc		32343*c*
			2943·9				33957*d*
		2920·8	2921·3		8sc	10	34224*cd*
		2917·7	2917·8		10nd	10	34262*cd*
		2893·9	2895·2		2sc		34536*cd*
		3848·6			4nd		35094*c*
		2836·7			4d		35241*c*
		2825·4	2825·8		2sc		35379*cd*
		2812·5	2826·9?		4nd	n	35545*c*
		2767·1			10n		36127*c*
			2714·6				36826*d*
		2709·4	2710·4		4sc	r	36900*cd*
		2708·6	2708·8		8sc	8nr	36907*cd*
		2700·1	2699·7		4d	n	37027*cd*
		2669·1			4d		37455*c*
		2665·0	2665·0		4sc	n	37512*cd*
			2652·3				37692*d*
			2609·4			r	38311*d*
		2608·7	2608·6		4nc	8r	38322*cd*
		2579·7			8sc		38752*c*
		2551·6	2552·0		4sc	r	39176*cd*
		2530·0			8nc		39513*c*
			2517·0			n	39717*d*
		2477·7			2sc		40347*c*
		2468·9			6d		40501*c*
		2451·9			8d		40771*c*
		2394·8			6d		41743*c*
		2380·0			8nc		42003*c*
		2364·8			6d		42272*c*
		2343·1			4nd		42666*c*
		2257·0?			2sd		44293*c*
		2299·3			8sc		43478*c*
		2257·0			4d		44293*c*
		2243·7			4d		44555*c*
		2239·0			4c		44647*c*
		2217·0			4d		45092*c*
		2210·0			4d		45234*c*
		2203·5			2d		45368*c*
		2139·0			4d		46735*c*

* 5348·0 Müller; 4345·1 Ketteler; 5352 Bernard; 5348 Rühlmann; 5348·8 Mascart.
† 4740·0 Hartley and Adeney.

TITANIUM—*continued.*

Arc Spectrum Cornu	Osc. Freq.	Arc Spectrum Cornu	Osc. Freq.	Arc Spectrum Cornu	Osc. Freq.	Arc Spectrum Cornu	Osc. Freq.
3509·9	28482	3347·0	29870	3235·0	30902	3215·8	31087
3504·3	28527	3346·8	29934	3232·7	30924	3201·7	31224
3392·8	29465	3339·7	29947	3228·0	30969	3190·2	31336
3386·2	29523	3338·2	30851	3223·1	31017	3163·0	31606
3382·0	29560	3240·4	30878	3221·7	31030	3162·4	31612
3371·2	29654	3237·5		3216·9	31076	3161·9	31616
3359·3	29869						

* Double.

TUNGSTEN.

Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lockyer, 'Phil. Trans.' clxxiii. 561 (1881).

Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.
5805·1	4sd	17221	5007·1	6sd	19966
5733·1	6sd	17437	4981·1	4sd	20070
5648·1	4sd	17700	4887·6	8sc	20454
5631·6	2sd	17752	4842·1	10sc	20646
5513·1	10sc	18133	4680·6	2sd	21358
5491·6	8sc	18204	4660·6	2sd	21450
5223·2	10sc	19140	4659·6	2sd	21455
5070·6	6sd	19716	4302·0	6sd	23238
5068·1	6sd	19725	4295·0	6sd	23276
5053·1	10sc	19784	4269·0	6sd	23418
5014·1	6sd	19938			

Lockyer has observed the following lines in the arc spectrum of Tungsten between wave-lengths 3900 and 4000:—3982·4, 3979·8, 3978·3, 3963·9, 3954·2, 3952·1, 3934·0.

URANIUM.

Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lockyer, 'Proc. Roy. Soc.' xxvii. 280; 'Phil. Trans.' clxxiii. 561 (1881).

Spark Spectrum		Intensity and Character	Osc. Freq.	Spark Spectrum		Intensity and Character	Osc. Freq.
Thalén	Lockyer			Thalén	Lockyer		
5913·1		8sd	16907	5481·6		10sc	18237
5619·1		6sd	17791	5479·6		10sc	18244
5579·1		6sd	17919	5477·1		10sc	18253
5562·6		6sd	17972	5474·6		10sc	18261
5527·1		10sc	18087	5384·1		6sd	18568
5509·1		6sd	18147	5027·1		6sd	19887
5493·6		10sc	18198	4731·1		6sd	21130

Tin.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil. Trans.' cliv. p. 139, 1864.
Mascart, 'Annales Scientifiques de l'École Normale,' iv. 1866.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Cornu, 'Spectre Normal du Soleil,' Paris, 1881.
Liveing and Dewar, 'Phil. Trans.' clxxiv. p. 219, 1883.
Hartley and Adeney, 'Phil. Trans.' clxxv. p. 104, 1884.

I. Spark Spectrum				II. Arc Spectrum	Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Hartley and Adeney *d*	Liveing and Dewar *e*	I.	II.	
6840		6837·4			3n		14621*c*
6769							14769*a*
6573							15209*a*
*6447	†6452·3(3)	6452·8			10nc		15494*b*
*5798	†5798·1 3)	5798·4			10nc		17242*b*
*5630	†5630·1(4)				8sc		17756*b*
*5587	†5588·6(3)	5587·8			10nc		17888*b*
*5564	†5562·6(3)	5561·6			10nc		17972*b*
5366	†5368·6(1)				2sc		18621*b*
5347	†5347·6(1)				4sc		18694*b*
*5333	†5332·1(3)				8nc		18749*b*
5328							18763*a*
5287	†5289·6(1)				2sc		18899*b*
5224	†5224·2(2)				4sc		19136*b*
5098	†5100·6(2)	5100·0			6sc		19600*b*
	†5021·1(1)				2sd		19910*b*
	†4923·1(1)				4sc		20306*b*
4858	†4858·1(2)	4858·1			6sc		20568*b*
4584	†4584·6(1)	4584·7	4584·3		8sc		21806*bd*
*4523	†4524·1(4)	‖4523·9	4524·0		‡10nc		22098*bd*
			4324·6		2sd		23117*d*
			4215·3		2sd		23716*d*
			4057·0		2sd		24641*d*
			3961·8		6sd		25233*d*
			3947·0		2sd		25328*d*
			3906·6		8sd		25590*d*
			3859·0		8sd		25905*d*
			3800·3		8sc		26306*d*
			3783·4		8sd		26424*d*
			3779·0		8sd		26454*d*
			3763·9		6sd		26560*d*
			3745·1		10sd		26694*d*
			3734·4		8sd		26770*d*
			3727·0		6sd		26823*d*
			3707·6		8sd		26964*d*
			3686·7		2sd		27117*d*
			3667·6		2sd		27258*d*
			3655·5		2sd		27348*d*
			3623·9		4sd		27586*d*
			3616·9		4sd		27640*d*
			3609·3		8sd		27698*d*
			3598·3		10sd		27782*d*
			3574·0		8sd		27971*d*
			3549·7		6sd		28163*d*
			3539·3		4sd		28245*d*

TIN—*continued.*

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.	I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Hartley and Adeney *d*	Liveing and Dewar *e*	I.	II.		Hartley and Adeney *d*	Liveing and Dewar *e*	I.	II.	
3514·8		4sd		28442*d*	2660·2	2660·7	8sc		37576*de*
3487·3		4sd		28666*d*	2657·9		10nd		37612*d*
3471·1		2sd		28800*d*	2645·4		8sc		37790*d*
3412·7		8sd		29294*d*	2643·2		10nd		37821*d*
3390·4		2sd		29486*d*		2636·5			37918*e*
3351·8		10nd		29826*d*	2631·5		10nd		37990*d*
3230·0		10sc		30021*d*	2617·9		8sd		38187*d*
	3326·0			30057*d*	2613·8		4sd		38247*d*
3314·6		2sd		30160*d*	2611·0		4sd		38288*d*
3282·9		10nd		30452*d*	2606·3		4sd		38351*d*
3261·6	§3260·0	10sc		30648*de*	2598·5		4sd		38472*d*
3245·0		2sd		30807*d*	2593·6	2593·5	6sc		38545*de*
3219·6		4sd		31050*d*	2591·7		6sc		38573*d*
3218·0		4sd		31066*d*	2570·5	2571·0	8sc		38888*de*
3174·3	3175·0	10sc		31489*de*	2563·2		4nd		39002*d*
	3141·7			31820*e*	2557·7	2557·5	4sc		39087*de*
3140·6		2sd		31831*d*	2545·6	2546·1	8sc		39267*de*
3122·3		2sd		32023*d*	2530·8	2530·7	4sd		39502*de*
3131·0		4sd		31928*d*	2523·4	2523·5	4sd		39616*de*
3095·2		4sd		32294*d*	2514·0		4sd		39765*d*
3070·6		8sd		32556*d*	2506·0		4sd		39891*d*
3046·5		2sd		32814*d*	2499·3		4sd		39998*d*
3033·1	3033·0	10sc		32959*de*	2495·0	2495·5	8sc		40063*de*
3007·9	3008·5	10sc		33233*de*		2493·5			40091*e*
	2986·4			33475*e*	2488·0		8nd		40180*d*
	2913·1			34317*e*	2482·9	2483·1	8sc		40277*de*
2911·9		2sc		34331*d*	2455·5		2sd		40712*d*
2895·0		8sd		34532*d*	2449·4		6nd		40813*d*
2886·9		8sd		34628*d*	2445 2		2sc		40883*d*
2877·4		2sd		34750*d*	2436·4		8sd		41031*d*
2874·7		4sd		34775*d*	2433·3		4sd		41083*d*
2862·1	2862·8	10sc		34922*de*	2429·3	2429·5	10sc		41152*de*
2849·3		8sc		34987*d*	2421·8	2421·5	10sc		41280*de*
2847·6		8sc		35106*d*	2408·0	2407·9	2sd		41515*de*
	2839·5			35206*e*	2395·8		4sd		41726*d*
2838·9		10sc		35214*d*	2393·7	2392·5	4sd		41773*de*
	2813·5			35532*e*	2382·3		4sd		41962*d*
2812·5	2812·5	8sc		35545*de*	2381·7		2sd		41973*d*
2811·5		4sd		35557*d*	2368·3		8sd		42208*d*
2787·3	2787·5	4sd		35864*de*		2364·7			42274*e*
2784·0	2784·7	6sc		35902*de*		2357·7			42402*e*
	2779·5			35966*e*	2355·0	2354·5	10sc		42453*de*
2778·0		8sc		35985*d*	2335·3	2334·3	8sd		42817*de*
2778·8		8sc		35975*d*	2317·9	2317·0	8nc		43138*de*
2765·0		4sc		36155*d*	2288·1		6sd		43691*d*
2754·0		4sd		36299*d*		2286·9			43714*e*
2751·8		4sd		36328*d*		2282·5			43798*e*
2749·0		4sd		36365*d*		2275·4			43935*e*
2746·0		4sd		36405*d*	2270·0		8nd		44039*d*
2738·4		4sd		36506*d*	2268·6		4sd		44062*d*
2733·0		4sc		36578*d*	2267·1		2sd		44095*d*
2705·8		10sc		36947*d*		2251·0		10r	44411*e*
2664·9		8sd		37514*d*	2247·0		8sd		44490d

L 2

Yttrium.

Bunsen, 'Pogg. Ann.' clv. 366; 'Phil. Mag.' (4) l. 527.
Thalén, 'Om Spektra Yttrium, Erbium, Didym och Lanthan.' Stockholm, 1874.

Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.	Spark Spectrum Thalén	Intensity and Character	Osc. Freq.
6613·0	6	15117	5496·0	10	18190	4359·0	2	22934
6434·5	8	15537	5479·5	6	18245	4309·0	10	23200
6313·0	1	15836	5473·0	6	18266	4236·5	4	23597
6296·0	1	15878	5468·3	1	18282	4176·5	8b	23937
6236·0	2	16031	5466·0	8	18290	4167·0	6	23991
6217·5	4	16079	5437·0	4	18387	4142·5	4	24133
6206·0	1	16109	5423·5	2	18433	4127·0	4	24224
6190·5	10	16149	5416·0	1	18458	4102·5	2	24368
6181·0	6	16174	5402·0	10	18506			
6163·5	8	16220	5379·0	2	18585			
6149·0	8	16258	5320·0	2	18791	Arc Spectrum		
6137·0	1	16290	5288·0	4	18905			
6131·0	10	16306	5205·0	10	19209			
6126·0	1	16319	5199·5	10	19227	Lockyer		
6114·0	2	16351	5195·5	4	19242			
6106·5	2	16371	5122·5	8	19516			
6095·0	2	16402	5118·0	6	19533	3999·8		24994
6088·0	1	16421	5087·5	10	19650	3997·8		25006
6071·0	2b	16469	4981·5	4	20068	3996·1		25017
6036·0	4	16562	4973·0	1	20103	3991·0		25049
6022·5	1	16599	4881·0	10	20482	3987·4		25071
6018·5	6	16611	4859·0	2	20574	3982·7		25101
6008·5	6	16638	4854·0	10	20595	3981·7		25107
6002·5	8	16655	4852·0	2	20604	3981·0		25112
5986·5	10	16699	4844·0	2	20638	3978·7		25126
5774·0	4	17314	4838·5	2	20661	3977·9		25131
5742·5	2	17409	4822·0	4	20732	3973·8		25157
5705·5	1	17522	4799·0	2	20831	3972·0		25169
5674·0	1	17619	4760·5	4	21000	3962·1		25231
5662·0	10	17656	4751·0	4	21041	3952·4		25293
5647·0	2	17703	4732·0	1	21126	3950·6		25305
5643·0	2	17716	4728·0	1	21144	3949·4		25313
5604·5	6	17837	4681·5	4	21354	3947·2		25332
5576·0	6	17929	4657·5	1	21464	3944·6		25343
5566·5	2	17959	4643·0	8	21531	3943·7		25349
5544·5	6	18030	4526·5	6	22085	3943·5		25349
5543·0	6	18036	4505·0	4	22191	3937·8		25387
5526·5	8	18089	4486·0	2	22285	3936·3		25397
5520·0	6	18110	4464·5	1n	22392	3933·8		25413
5512·0	1	18137	4422·0	8	22608	3930·0		25438
5509·0	8	18147	4397·0	4	22736	3915·7		25530
5502·5	4	18168	4374·0	10	22856	3906·0		25594

Zinc.

Kirchhoff, 'Abh. Berl. Akad.' 1861.
Huggins, 'Phil. Trans.' cliv. 139, 1866.
Mascart, 'Ann. de l'École Normale,' iv. 1866.
Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. 1868.
Lockyer, Phil. Trans. clxiii. 253, 639, 1873.
Archives des Sciences. Genève, II. July, 1879.
Liveing and Dewar, 'Proc. Roy. Soc.' Nov. 27, 1879; 'Phil. Trans.' clxxiv. 205 (1883).
Hartley and Adeney, 'Phil. Trans.' clxxv. 63 (1883).
Cornu.

I. Spark Spectrum				II. Arc Spectrum		Intensity and Character		Osc. Freq.
Huggins *a*	Thalén *b*	Kirchhoff *c*	Mascart *d*	Liveing and Dewar *e*	Cornu *f*	I.	II.	
6581								15191*a*
*6360	†6362·8(4)	6363·2	6360·7			10c		15712*b*
6211								16096*a*
6100	†6102·2(1)	6102·1				10nc		16383*b*
6041								16549*a*
	†6022·7(1)	6022·2				8nc		16599*b*
5910								16916*a*
5894	†5893·6(2)	5893·6				8sc		16962*bc*
5814	†5816·1(2)					4sd		17189*b*
5755	†5756·1(1)					2sd		17368*b*
5741	§†5745·1(1)					2sd		17401*b*
	‡5608·1					4sd		17826*b*
5577	†5577·6(1)					4sd		17924*b*
5563	†5563·1(1)					4sd		17970*b*
	‡5465·6					4sd		18291*b*
	†5436·1(1)					2sd		18390*b*
5333	†5336·1(1)					2sd		18735*b*
5247	†5249·7(1)					4sd		19043*b*
5232	†5233·2(1)					4sd		19103*b*
5157	†5158·7(1)					4sd		19379*b*
5122	†5121·1(1)					4sd		19521*b*
5117								19537*a*
5083								19668*a*
5072	†5074·1(1)					4sd		19702*b*
5049	†5048·1(1)					4sd		19803*b*
4970	†4971·1(1)					4sd		20111*b*
4924	†4923·9(3)	4926·2	4923·2	not seen		10nc		20302*b*
4911	†4911·3(3)	4911·5	4910·5			10nc		20355*b*
	†4878·1(1)					2sd		20494*b*
4867	†4865·1(1)					2sd		20549*b*
*4809	†4809·8(4)	4810·1	4809·0	(4809·8)		10sc	r	20785*b*
*4722	†‖4721·5(4)	¶4721·4	4720·6	(4721·4)		10sc	r	21173*b*
*4679	†‖4679·6(4)	¶4679·8	4678·5	not seen		10sc		21363*b*
		Hartley and Adeney						
		3813·5				1sd		26215*c*
		3811·5				1sd		26229*c*
		3757·5				2sd		26606*c*
		3720·5				4sd		26870*c*
		3713·5				1sd		26921*c*
		3704·5				4sd		26986*c*
		3694·0				4sd		27063*c*
		3683·0				4sd		27144*c*

ZINC—*continued.*

I. Spark Spectrum	II. Arc Spectrum		Intensity and Character	Osc. Freq.
Hartley and Adeney *e*	Liveing and Dewar *e*	Cornu *f*	I.	
3668·0			4sd	27255*c*
3645·4			2sd	27424*c*
3632·2			4sd	27518*c*
3623·4			4sd	27590*c*
3578·2			2sd	27938*c*
3560·8			2sd	28075*c*
3536·8			1sd	28265*c*
3529·8			2sd	28321*c*
3509·2			1sd	28488*c*
3491·8			2sd	28629*c*
3344·4	3342·0		10nc	29900*ce*
3301·7	3301·0		10nc	30383*ce*
3281·7	3281·0		8nc	30465*ce*
3255·8			2sd	30721*c*
3238·7			2sd	30867*c*
3234·6			2sd	30906*c*
3075·6			8sc	32504*c*
3071·7	3070·0		8sd	32544*ce*
3035·4	3035·0		8sd	32937*c*
3024·1			2sd	33058*c*
3017·5	3017·0		4sd	33134*ce*
2996·7			2sd	33360*c*
2959·5			2sd	33780*c*
2886·4			2sd	34634*c*
2856·3			2sd	35000*c*
2800·1	2800·0		8nc	35701*ce*
2782·5			1sd	35927*c*
2778·4			2sd	35980*c*
2770·2	2770·0		8nc	36088*ce*
2754·5	2756·0		7nd	36284*ce*
2719·7			2sd	36758*c*
2711·5	2713·3		2sc	36857*ce*
2683·8	2684·0		2sc	37248*ce*
	2670·5			37435*e*
2657·0			2sd	37625*c*
2607·6	2608·5		4sd	38343*ce*
2592·3			1sd	38564*c*
2589·3			1sd	38609*c*
2585·1			1sd	38671*c*
2581·4	2582·0		4sd	38722*ce*
2574·8			4sd	38826*c*
2569·4	2569·7		4sd	38906*ce*
2557·3			10nc	39091*c*
2535·0			2sd	39435*c*
2532·3			2sd	39477*c*
2526·3			8sd	39571*c*
2521·3			8sd	39650*c*
2514·7	2516·0		8sd	39738*ce*
2508·7			8sd	39849*c*
2501·5			10nc	39950*c*
2497·0			1sd	40035*c*
2496·5			1sd	40043*c*
2490·4	2491·5		8nd	40132*ce*
2485·9			8nd	40214*c*

ZINC—*continued*.

I. Spark Spectrum	II. Arc Spectrum		Intensity and Character	Osc Freq.
Hartley and Adeney *c*	Liveing and Dewar *e*	Cornu *f*	I.	
2485·0			4sd	40228*c*
2483·7			2sd	40249*c*
2479·2	2480·0		2sd	40316*ce*
2472·2			4sd	40437*c*
2468·3			2sd	40501*c*
2465·9	2464·5		4sd	40551*ce*
2462·8			2sd	40591*c*
2461·3			4sd	40616*c*
2459·8			2sd	40640*c*
2450·0			4sd	40803*c*
2441·6	2440·0		4sd	40957*ce*
2437·7			4sd	41009*c*
2433·9			2sd	41073*c*
	2430·0			41139*e*
2427·0			8sd	41190*c*
2423·3			4sd	41252*c*
2420·7			2sd	41297*c*
2418·8			8sd	41346*c*
2408·4			4sd	41508*c*
2405·3			4sd	41561*c*
2401·9			1sd	41620*c*
2398·7			1sd	41675*c*
2396·4			1sd	41715*c*
2393·3			1sd	41769*c*
2390·1			1sc	41825*c*
2384·2			1sd	41929*c*
2382·8			1sd	41953*c*
2371·7			1sd	42150*c*
2367·8			1sd	42219*c*
2348·7			4sd	42562*c*
2346·7			1sd	42600*c*
2329·3			1sd	42918*c*
2315·0			4sd	43183*c*
2308·8			4sd	43299*c*
2267·0			2sd	44093*c*
2255·0			2sd	44332*c*
2138·5		2138·5	4nc	46746*cf*
2104·2			2sd	47508*c*
2102·0			2sd	47558*c*
2099·0		2098·8	1nc	47628*cf*
2095·9			2sd	47696*c*
2085·4			2nd	47936*c*
2077·6			1sc	48119*c*
2068·4			1sd	48330*c*
2062·8		2063·4	1nd	48454*cf*
2060·8		2061·0	1nc	48506*cf*
2024·2		2024·3	1nc	49384

* Observed also by Lecoq de Boisbaudran in the Spark Spectrum of Zinc Chloride solution, who has also noted lines at 5184 and 4630.

† Observed also by Lockyer. The 'indices' attached to these numbers denote the comparative 'lengths' of the lines as given by Lockyer.

‡ 'Could not be identified,' Lockyer.

§ 5739 G. Johnstone Stoney.

‖ Observed also in the Arc by Ångström.

¶ 4725·0 and 4680·0, Hartley and Adeney.

Zirconium.

Thalén, 'Nova Acta Soc. Upsal.' (III.) vi. (1868).
Lockyer, 'Phil. Trans. clxxiii. 561 (188).

I. Spark Spectrum	II. Arc Spectrum	Intensity and Character		Osc. Freq.
Thalén *a*	Lockyer *b*	I.	II.	
6343·8		6sd		15759*a*
6310·3		6sd		15842*a*
6140·7		10sc		16280*a*
6132·7		6sd		16301*a*
6127·2		10sc		16316*a*
5384·6		4sd		18566*a*
5349·6		6sd		18687*a*
5190·7		6sd		19260*a*
4815·1		10sc		20762*a*
4771·1		10sc		20953*a*
4738·6		10sc		21097*a*
4709·6		10sc		21227*a*
4686·6		10sc		21331*a*
4497·6		4sd		22228*a*
4494·6		4sd		22242*a*
4443·1		4sd		22500*a*
4380·1		4sd		22824*a*
4370·0		4sd		22876*a*
4360·0		4sd		22928*a*
4242·0		4sd		23567*a*
4241·5		4sd		23569*a*
4228·5		4sd		23642*a*
4209·5		4sd		23748*a*
4209·0		4sd		23751*a*
4155·0		8sc		24060*a*
4149·0		8sc		24095*a*
	3998·5			25002*b*
	3990·4			25053*b*
	3989·0			25061*b*
	3988·2			25063*b*
	3984·1			25092*b*
	3980·6			25114*b*
	3978·1			25130*b*
	3976·8			25138*b*
	3974·5			25153*b*
	3972·7			25164*b*
	3971·5			25172*b*
	3965·7			25209*b*
	3962·8			25227*b*
	3957·2			25263*b*
	3940·7			25368*b*
	3935·0			25405*b*
	3933·8			25413*b*
	3933·0			25447*b*
	3928·6			25497*b*
	3920·8			25529*b*
	3915·9			25534*b*
	3915·2			25596*b*
	3906·0			25633*b*
	3900·0			

WAVE-LENGTH TABLES OF THE SPECTRA OF COMPOUNDS.

AMMONIA.

Dibbits, 'De Spectraal Analyse,' 1863.
Mitscherlich, 'Ann. Chim. Phys.' lxix. 169, 1868.
Hofmann, 'Pogg. Ann.' xxvii. 92 (1872).
Lecoq de Boisbaudran, 'Compt. Rend.' ci. 43.

Flame Spectrum		Intensity and Character	Osc. Freq.	Flame Spectrum		Intensity and Character	Osc. Freq.
Dibbits *a*	Lecoq de Boisbaudran *b*			Dibbits *a*	Lecoq de Boisbaudran *b*		
(1) 6629		$1b^v$	15081*a*	ζ 5807		3s	17216*a*
α 6629		5s	15081*a*	ζ 5754		3s	17374*a*
α 6542		5s	15281*a*	η 5705	α 5702	8n	17528*ab*
(2) 6420		$1b_{17}$	15572*a*	(4) 5664		5s	17650*a*
				(4) 5617		$2b_9$	17798*a*
β 6302	γ 6325		15806*b*	(5) 5466	δ 5470	$2b_9^v$	18283*ab*
	γ 6293	$6b_4$	15886*b*	θ 5382		8s	18575*a*
γ 6227		2n	16054*a*	(6) 5330		$6b^r$	18756*a*
γ 6185	η 6180	5n	16170*ab*	ι *5284	ε 5252	$8b_1^v$	18923*ab*
γ 6117		2n	16343*a*	(7) 5158		$8b^v$	19382*a*
δ 6036	β 6045	7n	16538*b*	κ 5128		$7b^r$	19495*a*
δ 6008		6n	16640*b*	λ 5079		$4b_4^r$	19683*a*
ε 5982		6s	16712*a*	(8) 4997		$7b_4^r$	20006*a*
ε 5970	ζ 5964	5n	16754*ab*	μ 4782		$4b_{17}^r$	20906
(3) 5834		$1b_{12}$	17136*a*				

* Double.

The spark spectrum of ammonia, according to Lecoq de Boisbaudran, shows one broad band at 5657 (5656·5 Schuster) which, with a finer slit, is resolved into two bands, 5681 of intensity 7, and 5643 of intensity 8 (5686 to 5627 Schuster). Lecoq de Boisbaudran obtained the 'Flame Spectrum' also by use of the spark; its production appears to depend upon the presence of oxygen.

Barium Oxide.

Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Flame Spectrum	Intensity and Character	Osc. Freq.	Flame Spectrum	Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran			Lecoq de Boisbaudran		
6819	1n	14661	5768	$4b_3$	17332
λ 6499	$5b_7{}^v$	15382	η 5719	$8b_3$	17480
6448	2n	15504	5647	$8b^v$	17703
ζ 6297	8n	15876	5613	2n	17810
6239	4b	16024	[α *5536	9s]	18058
γ 6178	5b	16184	δ 5492	$9b_4{}^v$	18203
6108	8b	16367	5461	1n	18306
6031	$9b^v$	16576	ε 5346	$8b_7{}^v$	18700
5995	2n	16676	θ 5215	$8b_5{}^v$	19170
β 5938	1b	16836	ι 5089	$7b_3{}^v$	19644
5867	$9b^v$	17040	5019	$2b_3$	19918
μ 5824	$5b_4$	17165	4974	$2b_2$	20098
			κ 4873	$6b_5$	20515
			4794	$1b_2$	20853

* Due to the *metal* itself.

Bismuth Chloride.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169, 1868.

Mitscherlich	Intensity	Osc. Freq.	Mitscherlich	Intensity	Osc. Freq.
6582	1	15189	5717	6	17486
6499	1	15382	5681	6	17597
6472	2	15447	5650	5	17694
6406	2	15606	5625	5	17772
6359	2	15721	5593	5	17874
6312	2	15838	5527	4	18088
6270	3	15944	5494	4	18196
6226	3	16057	5459	4	18313
6182	3	16171	5428	4	18418
6140	3	16282	5398	3	18520
6095	4	16402	5370	3	18616
6050	4	16524	5320	3	18791
6018	4	16612	5286	3	18912
5976	4	16729	5232	3	19108
5932	5	16853	5207	3	19199
5886	5	16985	5184	2	19284
5834	6	17136	5156	2	19389
5795	6	17251	5139	2	19453
5756	6	17368	5109	1	19568

Bismuth Oxide.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169 1868.

Mitscherlich	Intensity	Osc. Freq.	Mitscherlich	Intensity	Osc. Freq.
6382	b^v	15664	5582	b^v	17910
6194	b^v	16140	5444	b^v	18363
6039	b^v	16554	5328	b^v	18763
5873	b^v	17022	5220	b^v	19150
5717	b^v	17486			

Boron Trioxide.

Thalén, Upsala 'Universitets Årsskrift,' 1866.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Flame Spectrum			Intensity and Character	Osc. Freq.
Thalén *a*	Lecoq de Boisbaudran *b*	Salet *c*		
	6397	6400	$3b_1$	15628*b*
	6210	6210	$4b_2$	16098*b*
	6031	6030	$3b_2$	16576*b*
5781	δ 5807	5800	$7b_3$	17216*b*
5473	α 5480	5480	9n	18243*b*
	α 5439		$2b_2$	18380*b*
5188	β 5192	5200	$8b_6$	19255*b*
4957	γ 4941	4910	$7b_7$	20232*b*
	ϵ 4721	4700	$5b_5$	21180*b*
	4529	4540	$3b_3$	22072

Calcium Chloride.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169, 1868.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Flame Spectrum	Intensity and Character	Osc. Freq.	Flame Spectrum	Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran			Lecoq de Boisbaudran		
6442	$5b_5$	15519	β 5933	$9b_2^r$	16850
ϵ 6348	2n	15748	ζ 5817	5n	17186
ϵ 6320	2n	15818	5728	2n	17453
η 6265	9n	15957	*δ 5543	$6b_3^v$	18035
α 6202	10s	16119	*δ 5517	$4b_2^r$	18121
α 6181	10s	16174	[†4226	3s]	23656
γ 6068	7s	16479			
γ 6044	6s	16540			

* Probably due to the oxide. † Due to the metal.

Calcium Bromide.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169, 1868.

Mitscherlich	Intensity and Character	Osc. Freq.
6266	6s	15955
6242	6s	16016
6102	4s	16383

Calcium Fluoride.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169, 1868.

Mitscherlich	Intensity and Character	Osc. Freq.
6060	4s	16497
6026	4s	16590
5328	5n	18763
5301	5n	18859

Calcium Iodide.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169, 1868.

Mitscherlich	Intensity and Character	Osc. Freq.
6270	6s	15944
6252	6s	15990
6177	4s	16184

Calcium Oxide.

Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Lecoq de Boisbaudran	Intensity and Character	Osc. Freq.
β 6220	$4b_{12}$	16073
5995	$3b_2$	16676
γ 5543	$6b_3^v$	18035
a 5517	$4b_2^v$	18120

Carbon Hydride (*see* Carbon).

Angström and Thalén, 'Nova Acta Reg. Soc. Upsal.' ix. 1875.
Piazzi-Smyth, 'Phil. Mag.' (4) xlix. 24, 1875; (5) viii. 107 (1879).
Watts, 'Phil. Mag.' (4) xlix. 104; 'Nature,' xxiii. 197, 266, 361.
Attfield, 'Phil. Mag.' (4) xlix. 106.
Liveing and Dewar, 'Proc. Roy. Soc.' xxx. 152, 490, 494 (1880); xxxiii. 403; xxxiv. 123, 418 (1882); 'Nature,' xxii. 620; xxiii. 265, 338; xxv. 545.
Lockyer, 'Proc. Roy. Soc.' xxx. 335, 461 (1881).
Wüllner, 'Wied. Ann.' N.F. xiv. 355, 363.
Hasselberg, 'Wied. Ann.' N.F. xv. 45 (1882).
Deslandres, 'Ann. Chim. Phys.' (6) xiv. 5 (1888).

Carbon Nitride.

Fox-Talbot, 'Phil. Mag.' (3) iv. p. 114.
Draper, 'Phil. Mag.' (3) xxxii. p. 108 (1848).
Dibbits, 'De Spectraal Analyse,' 1863; 'Pogg. Ann.' cxxii. 497 (1864).
Morven, 'Ann. Chim. Phys.' iv. 305 (1865).
Plücker and Hittorf, 'Phil. Trans.' clv. 1 (1865).
Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169 (1868).
Watts, 'Phil. Mag.' xxxviii. 249 (1869); xli. 12 (1871); 'Nature,' xxiii. 197, 266, 361.
Herschell, 'Corr. Math. et Phys. par Quetelet,' 5, p. 254.
Wüllner, 'Pogg. Ann.' cxliv. 517 (1871).
Liveing and Dewar, 'Proc. Roy. Soc.' xxx. 152, 494 (1880); xxxiii. 403; xxxiv. 123, No. 223 (1882); 'Nature,' xxiii. 265, 338.
Lockyer, 'Proc. Roy. Soc.' xxvii. 308; 'Studies in Spectrum Analysis.'
Ciamician, 'Wiener Berichte,' 1880.
Wesendonck, 'Wied. Ann.' N.F. xvii. 427 (1881).
Piazzi-Smyth, 'Nature,' xxviii. 340 (1883).
A. S. Herschell, 'Phil. Trans. Ed.' xxx. 154.
Thalén, 'Le Spectre du Fer' (1884).
Deslandres, 'Ann. Chim. Phys.' (6) xiv. 5 (1888).

	Dibbits *a*	Thalén *b*	Watts *c*	Plücker and Hittorf *d*	Liveing and Dewar *e*	Lockyer *f*	Intensity and Character	Osc. Freq.
	(1)7080	7102		6800			2b$_2$	14702*d*
	(2)6906	6938		6700			8b^v	14921*d*
	(3)6657	6670		6495·4			7b^v	15391*d*
	(4)6486	6477		6426·7			5b^v	15556*d*
	(5)6334	6344		6312·3			5b^v	15837*d*
	(6)6193	6200		6206·2			5b^v	16108*d*
	(7)6010	6022					4b^v	16617*ab*
	(8)5892	5888					4b^v	16973*ab*
	(9)5750	5746					4b^v	17392*ab*
		5632					3b^v	17750*b*
		5498					2b^v	18183*b*
		5389					2b^v	18551*b*
		5245					1b^v	19060*b*
	4609	4607	4600	(4600)	4600		10b^r	21713*abce*
	4583	4582	4574	4571·5	4574		10b^r	21842*abcde*
	4559	4548	4550	4548·5	4550		9b^r	21965*abcde*
ζ	4537	4526	4534	4526·1	4532		9b^r	22063*abcde*
	4521	4505	4514	4508·2	4515		8b^r	22153*abcde*
	4508		4505	4495·3	4505		7b^r	22199*acde*
	4500		4502	4490·8	4500		6b^r	22224*acde*
				4377·0	*4381·5			22816*e*
				4367·1	*4371·5			22869*e*
				4361·3	*4364·5			22905*e*
	4208†	4215·0	4220	(4215·6)	4218	4215·6	10b^r	23716*bf*
						4210·0		23746*f*
						4199·9		23803*f*
	4188†	4197·0	4210	4199·6	4205	4197·2	10b^r	23819*bf*
						4191·0		23853*f*
						4187·4		23874*f*
						4186·5		23879*f*
θ						4186·4		23880*f*
						4184·4		23891*f*
						4183·5		23896*f*
						4182·6		23901*f*
						4182·2		23903*f*
	4171†	4180·5	4190	4183·3	4192	4180·4	9b^r	23914*bf*
						4178·7		23924*f*

* 'Probably not connected with the presence of nitrogen.'—Liveing & Dewar, 'Proc. Roy. Soc.' No. 223, 1882.

† Observed also by Mitscherlich: 4212, 4197, 4182, 4170, 4159, 4147, 4136, 3859, 3847, 3839.

CARBON NITRIDE—*continued.*

Dibbits *a*	Thalén *b*	Watts *c*	Plücker and Hittorf *d*	Liveing and Dewar *e*	Lockyer *f*	Intensity and Character	Osc. Freq.
					4177·8		23929*f*
					4176·6		23936*f*
4155†	4176·0	4174	4166·5	4176	4175·8		23941*bf*
					4174·4		23949*f*
					4173·5		23954*f*
					4172·6		23959*f*
					4171·4		23965*f*
					4169·7		23976*f*
					4168·8		23981*f*
					4168·1		23985*f*
4147†	4167·3	4166	4156·1	4165	4167·2	8b^r	23990*bf*
4142†		4160	4150·2	4158	4157·5	8b^r	24046*f*
		4158			4151·5	7b^r	24081*f*
			Deslandres		4144·1	6b^r	24124*f*
3854†			3883·1	3882·7	3882·8 ?	10b^r	25747*ef*
3839†			3871·4	3871	3870·6 ?	9b^r	25828*f*
					3867·1		25851*f*
					3866·4		25856*f*
					3865·4		25862*f*
					3864·8		25867*f*
					3863·9		25873*f*
					3863·1		25878*f*
					3862·2		25880*f*
3827†			3862·1	3862	3861·6	8b^r	25888*f*
					3860·8		25893*f*
					3859·8		25900*f*
					3859·2		25904*f*
					3858·3		25910*f*
					3858·0		25912*f*
3815			3854·7	3854·5	3857·5	7b^r	25915*f*
					3856·6		25921*f*
					3856·0		25926*f*
					3855·4		25929*f*
			3850·9	3850		6b^r	25960*d*
			3590·3	3589		10b^r	27844*d*
			3585·8	3583		9b^r	27879*d*
			3360·1	3360		10b^r	29752*d*
				‡2718 &c.		b^r	36781*e*
				‡2588 &c.		b^r	38628*e*
				‡2479 &c.		b^r	40327*e*
				‡2373 &c.		b^r	42128*e*

† Observed also by Mitscherlich : 4212, 4197, 4182, 4170, 4159, 4147, 4136, 3859, 3847, 3839.
‡ 'Probably due to nitrogen.'— LIVEING and DEWAR, 'Proc. Roy. Soc.' No. 223, 1882.

Carbon Oxide.

Plücker, 'Pogg. Ann.' cv. 77 (1858); cvii. p. 533 (1859).
Wüllner, 'Pogg. Ann.' cxliv. p. 481 (1872).
Ångström, 'Pogg. Ann.' xciv. 141
Watts, 'Phil. Mag.' xxxviii. 249 (1869); xli. 12.
Ångström and Thalén, 'Nov. Act. Ups.' ix. 1875.
Wesendonck, 'Wied. Ann.' N.F. xvii. 427 (1881).
Thollon, 'Ann. Chim. Phys.' (5) xxv. 287 (1881).
Piazzi-Smyth, 'Phil. Trans. Edin.' xxx.; 'Phil. Mag.' xlix. p. 24.
A. S. Herschell, *ib.* xxx. 152.
Deslandres, 'Ann. Chim. Phys.' (6) xiv. 5 (1888).

Watts *a*	Ångström and Thalén *b*	Piazzi-Smyth and Herschell *c*	Intensity and Character	Osc. Freq.
	6853		1b	14588*b*
	6748		1b	14815*b*
	6622·0		3b^r	15097*b*
	6462		1b	15471*b*
6060	6078·0		4b^r	16448*b*
	5900		1b	16944*b*
	5817·0		3b^r	17186*b*
	5689		1b	17573*b*
5610·5	5607·5	5612·0	5b^r	17820*abc*
		5608·8	5b	17823*c*
		5607·0	5b	17829*c*
		5605·5	5b	17834*c*
	Fine lines too close to measure	5603·9	4b	17839*c*
		5602·0	4b	17845*c*
		5597·9	4b	17858*c*
		5595·9	4b	17865*c*
	5591·8	5593·4	3b	17873*c*
	5588·3	5590·8	3b	17881*c*
	5585·5	5587·6	3b	17892*c*
	5582·5	5584·5	3b	17902*c*
	5578·5	5580·6	2b	17914*c*
	5574·0	5577·2	2b	17925*c*
	5570·5	5573·0	2b	17938*c*
	5566·5	5568·6	2b	17953*c*
	5562·2	5563·9	1b	17967*c*
	5557·5	5559·0	1b	17984*c*
		5553·9		18000*c*
		5548·4		18018*c*
		5542·6		18037*c*
		5536·7		18056*c*
		5530·8		18075*c*
		5524·4		18096*c*
		5518·5		18116*c*
		5511·6		18138*c*
		5505·4		18159*c*
		5498·2		18182*c*
		5490·9		18207*c*
		5483·2		18232*c*
		5475·7		18257*c*
		5467·9		18284*c*
		5461·4 ?		18305*c*
		5454·0 ?		18330*c*
	5449		1b	18347*c*
		5444 ?		18363*b*
	5397·5		3b^r	18522*b*

CARBON OXIDE—*continued.*

Watts *a*	Ångström and Thalén *b*	Piazzi-Smyth and Herschell *c*	Intensity and Character	Osc. Freq.
	5370		1b^r	18616*b*
	5265		1b	18988*b*
		5198·7	4b^r	19230*c*
5198·4	5197·0	5198·2	6b^r	19232*c*
		5197·7	6b^r	19233*c* 19233*abc*
		5197·2	4b^r	19236*c*
		5196·3	2	19239*c*
		5195·7	5	19241*c*
	Fine lines too close to measure	5195·0	5	19244*c*
		5194·2	2	19247*c*
		5193·1	2	19251*c*
		5192·3	2	19254*c*
		5191·8	2	19256*c*
		5191·2	2	19258*c*
		5190·5	4	19260*c*
		5190·0	4	19262*c*
		5188·8	6	19267*c*
		5188·7	6	19267*c*
	5186·5	5186·9	12	19275*bc*
	5183·5	5184·9	6	19281*c*
		5184·3	6	19283*c*
	5181·5	5182·5	5	19290*c*
		5181·7	5	19293*c*
	5178·5	5180·1	5	19299*c*
		5179·2	5	19303*c*
	5175·0	5177·1	5	19310*c*
		5176·4	5	19313*c*
	5172·5	5174·1	5	19322*c*
		5173·0	5	19326*c*
	5169·	5170·9	5	19333*c*
		5169·6	5	19338*c*
	5166·2	5167·5	5	19346*c*
		5166·7	2	19349*c*
		5165·9	2	19352*c*
		5165·5	2	19354*c*
		5165·2	2	19355*c*
		5164·6	2	19357*c*
	5162·0			19367*b*
	5015·0		1b^r	19934*b*
4836·6	4833·5	4836·5	5b^r	20674*abc*
	Fine lines too close to measure			
	4822·5		4b	20730*b*
	4820·3		4b	20740*b*
	4818·1		4b	20749*b*
	4816·0		4b	20758*b*
	4813·5		3b	20769*b*
	4811·0		3b	20780*b*
	4808·6		3b	20790*b*
	4805·7		3b	20803*b*
	4802·8		2b	20815*b*
	4799·4		2b	20829*b*
	4796·0		2b	20845*b*
	4792·5		1b	20860*b*
	4788·8		4b	20876*b*
	4785·5		4b	20890*b*

CARBON OXIDE—*continued.*

Watts *a*	Ångström and Thalén *b*	Piazzi-Smyth and Herschell *c*	Intensity and Character	Osc. Freq.
	4780·6		1b	20912*b*
	4776·4		1b	20930*b*
	4772·2		1b	20948*b*
	4767·8		2b	20968*b*
	4762·8		2b	20990*b*
	4757·7		1b	21012*b*
	4753·0		3b	21033*b*
	4748·0		3b	21055*b*
	4697·0		2b^r	21284*b*
	4630		1b^r	21592*b*
	4568		1b	21885*b*
4505	4509·0	4516·9	5b^r	22166*abc*
4395	*4394·0	4393·0	4b^r	22752*abc*
	4292		1b	23292*b*
	4209·0		1b	23751*b*
	4131·0		3b^r	24200*b*

* 'At the negative pole this band appears slightly displaced towards the blue—and of equal intensity throughout—not sharp towards the red.'—SCHUSTER.

CHROMIUM CHLORIDE.

Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Spark Spectrum	Intensity and Character	Osc. Freq.	Spark Spectrum	Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran			Lecoq de Boisbaudran		
6393	$3b_8{}^v$	15637	5566	$3b_4{}^v$	17961
6048	$3b_8{}^v$	16529	*4649	2n	21504
5790	$3b_7{}^v$	17266	4343	$1b_2$	23018
5622	$2b_6{}^v$	17782			

* Double.

COPPER CHLORIDE.

Deacon, 'Ann. Chim. Phys.' (4) vi. 1.
Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).
Leeds, 'Quart. Journ. Science,' Jan. 1871.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Flame Spectrum	Intensity and Character	Osc. Freq.	Flame Spectrum	Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran			Lecoq de Boisbaudran		
6618	$6b_6$	15106	5670	4n	17631
η 6267	$8b_{16}{}^v$	15952	5629	4n	17760
6150	$9b_7{}^v$	16255	5563	$7b_4$	17971
ζ 6143	2s	16274	5506	10n	18157
6050	$9b_8{}^v$	16524	5489	3n	18213
6041	1s	16549	5463	5n	18300
5807	1n	17216	α 5439	9s	18380
5780	2s	17296	5422	2s	18438
5728	5n	17453	5405	4s	18496

COPPER CHLORIDE—*continued.*

Flame Spectrum Lecoq de Boisbaudran	Intensity and Character	Osc. Freq.	Flame Spectrum Lecoq de Boisbaudran	Intensity and Character	Osc. Freq.
5385	10n	18565	4704	$2b_4^v$	21252
5355	4n	18668	4674	$2b_3$	21389
ι 5305	8b	18844	4612	$2b_3^v$	21676
β †5260	$9b_2^v$	19006	4579	$6b_2^v$	21832
5239	7n	19082	θ_1 4522	$8b_5^v$	22107
5210	$2b_7$	19188	θ_1 4496	$8b_2^v$	22236
5148	$5b^v$	19419	γ_1 4436	$9b_5^v$	22536
κ 5087	$7b^v$	19652	γ_1 4412	$9b_2^v$	22658
κ 5049	$8b^v$	19798	γ_2 4353	$9b_4^v$	22966
ϵ 4983	$9b_5^v$	20062	γ_2 4331	$8b_1^v$	23083
ϵ 4945	$8b_5^v$	20216	θ_2 4281	$7b_4^v$	23352
δ 4882	$9b_5^v$	20478	θ_2 4260	$6b_1^v$	23467
δ 4847	$9b_2^v$	20625	4217	$3b_2^v$	23706
λ 4792	$7b_5^v$	20862	4192	$1b_1^v$	23848
λ 4757	$5b_2^v$	21015	4125	$1b^v$	24230

† Becoming 5269 – b.

COPPER BROMIDE.

Diacon, 'Ann. Chim. Phys.' (4) vi. 1.
Mitscherlich, 'Ann. Chim. Phys.' lxix. 169; 'Phil. Mag.' xxviii. 169.

Mitscherlich	Intensity and Character	Osc. Freq.	Mitscherlich	Intensity and Character	Osc. Freq.
5215	b^v	19170	4537	b^v	22034
5124	b^v	19510	4515	b^v	22142
5033	b^v	19863	4462	b^v	22405
4949	b^v	20200	4447	b^v	22480
4872	b^v	20520	4405	b^v	22695
4823	b^v	20728	4384	b^v	22803
4619	b^v	21643	4340	b^v	23035
4593	b^v	21766	4320	b^v	23141

COPPER IODIDE.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169 (1868); 'Phil. Mag.' xxviii. 169.

Mitscherlich	Intensity and Character	Osc. Freq.	Mitscherlich	Intensity and Character	Osc. Freq.
5393		18537	5073		19706
5314		18813	5018		19922
5232		19107	4959		20159
5144		19434	&c.		

Copper Oxide.

Mitscherlich, 'Ann. Chim. Phys.' (3) lxix. 169 (1863).
Diacon, 'Ann. Chim. Phys.' (4) vi. 1.
Leeds, 'Quart. Journ. Science,' Jan. 1871.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Flame Spectrum — Lecoq de Boisbaudran	Intensity and Character	Osc. Freq.
5370	$6b_{27}$	18616
5106	$2b_{17}$	19579
4946	$2b_{16}$	20212

Cyanogen (*see* Carbon Nitride).

Erbium Oxide.

Bunsen, 'Pogg. Ann.' clv. 366; 'Phil. Mag.' l. 527.
Lecoq de Boisbaudran, 'Compt. Rend.' lxxvi. 1080; 'Spectres Lumineux,' Paris, 1874.
Crookes, 'Proc. Roy. Soc.' xl. 77.

Flame Spectrum — Bunsen *a*	Flame Spectrum — Lecoq de Boisbaudran *b*	Intensity and Character	Osc. Freq. *b*	Flame Spectrum — Bunsen *a*	Flame Spectrum — Lecoq de Boisbaudran *b*	Intensity and Character	Osc. Freq. *b*
	δ 6609	7n	15126	5230	α 5228	$9b_2$	19122
6519	δ 6546	8n	15272		α 5204	9n	19210
	6492	3n	15399		5123	$2b_4$	19514
	6404	$1b_7$	15611		5038	$1b_2$	19843
	γ 5631	$8b_4$	17753	4867	η 4910	$4b_8$	20360
	θ 5514	$4b_{10}$	18130		4756	$1b_4$	21020
	5413	2n	18134		ϵ 4648	$6b_5$	21508
5404	β 5367	$9b_2$	18558		4568	$2b_6$	21885
	5346	$3b_2$	18700		ζ 4500	$5b_4$	22215
	5264	$4b_2$	18991				

Erbium Phosphate.

Bunsen and Bahr, 'Ann. Chim. Pharm.' cxxxvii. 1; 'Ann. Chim. Phys.' (III.) 1866.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Flame Spectrum — Lecoq de Boisbaudran	Intensity and Character	Osc. Freq.	Flame Spectrum — Lecoq de Boisbaudran	Intensity and Character	Osc. Freq.
6913	$1b_{11}$	14461	5391	$2b_3$	18544
6694	$5b_{10}$	14934	β 5238	9n	19085
6597	7n	15154	β 5208	9n	19196
α 6526	$9b_4$	15319	4928	$6b_5$	20286
ϵ 6432	$7b_5$	15543	4878	$7b_2$	20494
γ 5507	$7b_1$	18153	4567	$5b_{11}$	21890
γ 5463	$8b_1$	18300			

Gold Chloride.

Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Demarçay, 'Compt. Rend.' cvi. 1228.

Flame Spectrum		Intensity and Character	Osc. Freq.	Flame Spectrum		Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran				Lecoq de Boisbaudran			
	5913	$4b_{11}$	16907		5179	2n	19303
ϵ	5752	$6b_{11}$	17083	β_2	5158	7n b_8^v	19382
γ	5600	$8b_1$	17852		5141	4s	19446
	5477	3s	18253		5125	9n	19506
β_1	5458	9n	18316		5102	8n	19594
	5437	5s b_7	18387	δ	5080	6n	19679
	5418	4s	18452		5063	3s b_7^v	19745
	5364	5s	18637		5044	6n	19820
α_1	5348	9n	18693		4996	$4b_7^r$	20010
	5328	6n b_8^v	18763		4516	$2b_{10}$	22137
	5311	9n	18823		4430	$2b_4$	22566
	5286	4n	18912				
	5263	9n	18995				
α	5244	4n	19064				
	5222	9n b_9^v	19144				
	5210	6n	19188				

Hydrogen Oxide (*see* Water).

Iron Oxide.

Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).

Mitscherlich	Intensity and Character	Osc. Freq.	Mitscherlich	Intensity and Character	Osc. Freq.
6219	1b^v	16075	5632	5b^v	17750
6182	2b^v	16171	5444	4b^v	18363
5892	4b^v	16967	5420	2b^v	18445
5665	4b^v	17647			

Lead Oxide.

Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).
Leeds, 'Quart. Journ. Science,' Jan. 1871
Lecoq de Boisbaudran, 'Comp. Rend.' lxxvii. 1152; 'Spectres Lumineux,' Paris (1874).

Mitscherlich *a*	Lecoq de Boisbaudran *b*	Intensity and Character	Osc. Freq.	Mitscherlich *a*	Lecoq de Boisbaudran *b*	Intensity and Character	Osc. Freq.
6265		2b^v	19557*a*	5144		4b^v	19434*a*
6196		2b^v	16135*a*	4993		4b^v	20022*a*
5997		2b^v	16670*a*	4913		4b^v	20348*a*
5955		2b^v	16788*a*	4880		3b^v	20486*a*
5892	5904	3b^v	16933*b*	4852		3b^v	20604*a*
5665	5684	4b^v	17588*b*	4825		3b^v	20719*a*

LEAD OXIDE—*continued.*

Mitscherlich *a*	Lecoq de Boisbaudran *b*	Intensity and Character	Osc. Freq.	Mitscherlich *a*	Lecoq de Boisbaudran *b*	Intensity and Character	Osc. Freq.
5615	5610	4b^v	17820*b*	4664		2b^v	21434*a*
5460	5460	5b^v	18310*ab*	4593		2b^v	21766*a*
5414		5b^v	18465*a*	4468		2b^v	22375*a*
5328		5b^v	18763*a*	4381		1b^v	22819*a*
5273		5b^v	18959*a*	4296		1b^v	23270*a*
5220		4b^v	19151*a*				

MAGNESIUM HYDRIDE.

Liveing and Dewar, 'Proc. Roy. Soc.' xxvii. 294; xxx. 93; xxxii. 196.
Ciamician, 'Sitzungsber Akad. Wissensch. Wien.' 1880, p. 437.

Liveing and Dewar	Intensity and Character	Osc. Freq.	Liveing and Dewar	Intensity and Character	Osc. Freq.
5618	8b^r	17794	5210	10b^r	19188
&c.			&c.		
5566	8b^r	17961	5180	10b^r	19299
&c.			&c.		
5513	8b^r	18134			
5512	8b^r	18137	4849	8b^r	20617
5511	8b^r	18140	&c.		
&c.			4803	8b^r	20814
			&c.		

MAGNESIUM OXIDE.

Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.
Watts, 'Phil. Mag.' 1875.
Liveing and Dewar, 'Proc. Roy. Soc.' No. 187 (1878).

Lecoq de Boisbaudran *a*	Watts *b*	Liveing and Dewar *c*	Intensity and Character	Osc. Freq.
5006	5006·5	5000	8b^r	19968*b*
4994	4996·5	4990	7b^r	20008*b*
4984	4985·7	4980	5b^r	20051*b*
4974	4974·7	4969	4b^r	20095*b*
4966	4963·7	4957	2b^r } b$_g^r$	20140*b*
4958	4948·7	4945	2b^r	20201*b*
	4934	4930	1b^r	20261*b*
	4924		1b^r	20302*b*
	4914		1b^r	20343*b*
		4797		20839*c*

Strontium Chloride.

Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris (1874).
Bunsen, 'Phil. Mag.' (4) l. 533; 'Pogg. Ann.' clv. 230 (1875).

Flame Spectrum		Intensity and Character	Osc. Freq.
Lecoq de Boisbaudran *a*	Mitscherlich *b*		
γ6729	6718	$8b_4$	14857*a*
β6598	6609	$9b_4$	15152*a*
•[δ6464	6472	5n]	15466*a*
α6350	6336	$9b_1$	15743*a*
•6233	6195	5n	16039*a*

• Appears to be due to the Oxide.

Strontium Bromide.

Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).

Mitscherlich	Intensity	Osc. Freq.	Mitscherlich	Intensity	Osc. Freq.
6735	5s	14843	6488	5s	15409
6637	5s	15063	6402	3s	15615
6582	2n	15189	6336	2s	15778
6537	2n	15293			

Strontium Fluoride.

Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).

Mitscherlich	Intensity	Osc. Freq.	Mitscherlich	Intensity	Osc. Freq.
6609	8n	15127	5807	4s	17216
6501	8n	15378	5783	4s	17287

Strontium Iodide.

Mitscherlich, 'Ann. Chim. Phys.' lxix. 169 (1863).

Mitscherlich	Intensity	Osc. Freq.	Mitscherlich	Intensity	Osc. Freq.
6724	5s	14868	6559	4s	15242
6664	5s	15001	6468	3s	15456

WATER—*continued.*

Huggins *a*	Liveing and Dewar *b*	Intensity and Character	Oscillation Frequency
	3126·0	1	31980*b*
	3124·5	3	31995*b*
	3123·5	4	32005*b*
3122·5	3122·2	5	32018*b*
	3121·3	1	32028*b*
	3119·2	3	32049*b*
3117	3117·4	5	32067*b*
	3116·6	3	32076*b*
	3114·3	4	32100*b*
	3112·8	4	32115*b*
3111	3111·5	6	32128*b*
	3109·7	4	32147*b*
	3108·8	4	32156*b*
	3107·0	4	32175*b*
	3106·0	2	32185*b*
3105	3105·3	5n	32193*b*
3102	3102·7	4	32220*b*
	3101·6	5	32231*b*
	3100·6	2	32241*b*
3099	3099·0	5	32258*b*
	3098·3	4	32265*b*
	3096·3	4	32286*b*
	3095·8	4	32291*b*
	3094·8	4	32302*b*
3094	3094·2	4	32308*b*
	3092·0	5n	32331*b*
	3090·6	5	32346*b*
3090	3089·8	4	32354*b*
	3089·3	6	32360*b*
	3086·7	4	32388*b*
3085	3085·8	2	32397*b*
	3084.6	4	32410*b*
	3082·6	4	32431*b*
3082	3081·0	5	32448*b*
3080	3079·3	5	32465*b*
3077·5	3077·9	4	32480*b*
	3076·6	2	32494*b*
	3074·4	2	32517*b*
3074	3073·8	2	32523*b*
3073	3072·6	1	32536*b*
	3071·5	5	32548*b*
	3070·0	4	32564*b*
3068	3068·2	1n	32583*b*
	3067·2	5b▾	32593*b*
	3065·5	3	32612*b*
	3064·6	4	32621*b*
	3063·9	3	32629*b*
3062	3063·3	5b▾	32635*b*
	Second Series		
	3057·4	4	32697*b*
	3052·7	4	32748*b*
	3048·3	4	32792*b*
	3043·9	3	32843*b*
	3039·9	3	32886*b*
	3033·1	2	32960*b*

WATER—*continued.*

Liveing and Dewar	Intensity and Character	Osc. Freq.	Liveing and Dewar	Intensity and Character	Osc. Freq.
3030·3	2	32990	2945·2	4	33943
3027·6	1	33020	2944·2	1n	33955
3025·2	1	33046	2940·6	4n	33991
3023·4	1	33066	2940·3	3	34000
3022·5	1	33075	2938·5	1	34021
3022·0		33081	2937·8	4	34029
3021·4*	1	33088	2937·2	3	34036
3020·9	1	33093	2936·5	4	34044
3016·6	1	33140	2935·2	4	34059
3012·9	1	33181	2933·5	4	34079
3008·5*	1	33229	2931·0	1	34108
3005·3*	1	33265	2929·9	4	34120
3001·9	3	33302	2927·6	2n	34147
2998·7	1	33338	2927·1	4	34153
2997·8	3	33348	2926·3	3	34162
2996·6	3	33361	2924·8	1	34180
2994·8	1	33381	2924·4	3	34185
2992·9	1	33402	2923·8	2	34191
2991·7	2	33416	2921·5	3	34219
2990·5	1	33429	2919·8	4n	34238
2988·5	2	33451	2918·5	2	34254
2987·2	1	33466	2918·2	8	34257
2985·7	1	33483	2916·3	4	34279
2983·8	1n	33504	2915·7	4	34286
2982·9	1	33514	2913·5	4n	34313
2982·2	1	33522	2912·9	4	34319
2980·2	4n	33545	2911·4	4	34337
2979·4	4n	33554	2909·4	2	34360
2977·8	4n	33572	2908·3	4	34374
2975·1	4n	33602	2907·3	4	34386
2973·9	1	33616	2906·6	2	34394
2972·2	1	33635	2906·0	1	34401
2971·1	1	33647	2903·7	6	34428
2970·7	2	33652	2902·5	8	34442
2970·0	2	33660	2900·9	2	34461
2968·5	1	33677	2900·2	4	34470
2968·0	1	33682	2899·5	2	34474
2967·1	1	33693	2898·8	2	34486
2966·5	1	33700	2898·1	3	34495
2965·5	3	33711	2897·6	4n	34501
2962·9	2	33740	2897·1 ?	1	34507
2962·1	1	33750	2896·1	3	34518
2960·0	4	33773	2894·2	1	34541
2958·9	1	33786	2893·5	4n	34549
2957·1	2	33807	2892·9	2	34557
2956·3	1	33816	2890·8	10	34582
2955·5	1	33825	2890·2	4	34589
2954·5	1n	33836	2889·8	4	34594
2953·2	1	33851	2889·2	1	34601
2952·5	1	33859	2888·5	1	34609
2951·7	1	33868	2887·5	3	34621
2951·2	1	33874	2886·3	1	34636
2950·7	1	33880	2886·1	1	34638
2950·1	4	33888	2885·3	4	34648
2948·5	2	33905	2884·2	4	34661
2947·5	3n	33917	2882·5	4	34681
2946·5	1	33928	2881·8	4	34690

WATER—*continued.*

Liveing and Dewar	Intensity and Character	Osc. Freq.	Liveing and Dewar	Intensity and Character	Osc. Freq.
2881·1	1	34698	2815·6	3	35505
2880·3	2n	34708	2814·9	2	35514
2878·3	5n	34733	2813·5	1n	35532
2875·8	4n	34762	2812·4	1n	35545
2875·0	5n	34772	2812·1	1	35549
2871·9	4	34809	2811·7	1	35554
2871·5	4	34814	2811·3	1	35559
2869·5	4	34838	2811·2	4	35561
2868·3	4	34853			
2866·0	4	34881	Third Series		
2865·5	1	34887	2806·8	2	35616
2863·3	4	34914	2805·4	1	35634
2861·7	4	34933	2804·2	1	35649
2860·3	4	34952	2802·9	2	35666
2859·4	4	34963	2799·8	4	35705
2857·6	4	34983	2797·6	1	35733
2855·4	4	35010	2796·9	2	35742
2854·9	4	35016	2795·7	1	35758
2853·9	4	35029	2793·8	2	35782
2852·2	5	35050	2791·7	1	35809
2850·2	4	35074	2790·5	2	35824
2849·5	4	35083	2789·8	1	35833
2848·8	4	35091	2789·1	1	35842
2847·4	4	35110	2788·3	1	35853
2846·3	4	35122	2787·7	1	35860
2845·4 ?	1	35133	2786·5	3	35876
2844·4	5	35146	2784·8	1	35898
2843·1 ?	1	35162	2783·2	3	35918
2842·7	4	35167	2780·7	1	35951
2842·2	4	35173	2779·2	2	35970
2841·0	4	35188	2778·6	1	35978
2840·1	1	35199	2777·4	1	35993
2838·8	10	35214	2776·1	2	36010
2836·7	2	35241	2774·9	2	36026
2835·8	2	35252	2773·8	1	36040
2835·0	2	35262	2772·3	1	36059
2834·0	1	35275	2770·9	1	36078
2833·3	2	35283	2770·0	1	36089
2831·4*	4	35307	2769·1	1	36101
2829·8	4n	35327	2768·2	1	36113
2829·2	1	35334	2767·3	1	36125
2828·7	5	35341	2766·3	2	36138
2828·3	1n	35346	2764·1	3	36166
2826·3	4	35371	2762·6	1	36186
2825·2	3n	35384	2761·4	3	36202
2824·8	4	35389	2759·8	3n	36223
2824·0	1	35400	2758·9	1	36234
2822·3	3	35421	2757·0	3	36259
2821·8	4	35427	2754·7	1	36290
2821·2	1	35435	2753·1	2	36311
2820·7	1	35441	2750·9	2	36340
2820·1	5	35448	2748·3	3	36374
2819·3	1	35458	2745·9	3	36406
2818·7	3	35466	2742·7	1	36448
2818·2	1	35472	2740·2	3	36482
2817·1	4	35486	2737·8	3	36514
2816·1	3	35499	2735·5	2	36545

WATER—*continued.*

Liveing and Dewar	Intensity and Character	Osc. Freq.	Liveing and Dewar	Intensity and Character	Osc. Freq.
2734·3	1	36560	2652·6	1	37688
2733·0	2	36578	2651·3	4	37706
2732·1	3	36590	2650·7	1	37714
2730·6	2	36611	2648·2	4	37750
2729·9	1	36620	2645·7	4	37786
2728·2	2	36643	2644·1	1	37809
2726·1	3	36672	2643·2	2	37821
2724·8	2	36689	2642·2	1	37836
2723·5	3	36707	2640·5	4	37860
2721·6	2	36732	2638·5	3	37889
2719·8	3	36757	2636·9	1	37912
2718·2	1	36765	2635·7	3	37929
2717·2	3	36792	2634·8	2	37942
2715·8	2	36816	2633·3	1	37964
2714·5	3	36828	2632·4	1	37977
2713·6	1	36841	2631·3	5n	37993
2711·6	3	36867	2628·3	1	38036
2710·6	1	36881	2627·7	1	38044
2709·6	3	36895	2627·2	1	38052
2707·2	1	36928	2625·9	2	38071
2706·2	2	36941	2624·3	4n	38094
2705·2	2	36955	2623·3	1	38108
2704·3	1	36967	2622·8	1	38118
2701·6	4	37004	2622·2	1	38124
2699·7	1	37030	2621·4	2	38136
2698·8	3	37042	2620·6	1	38148
2697·8	1n	37056	2618·9	3	38172
2696·1	1	37080	2618·1	1	38184
2695·4	2	37089	2617·7	1	38190
2693·8	2	37111	2617·0	1	38200
2693·2	1	37120	2616·5	1	38207
2692·5	1	37133	2615·7	1	38219
2691·7	2	37140	2614·9	3	38222
2690·6	2	37157	2613·5	2n	38251
2688·9	3	37179	2612·5	1	38266
2687·7	2	37195	2611·0	2	38287
2687·2	1	37202	2609·7	1	38307
2686·4	1	37214	2608·9	1	38319
2685·5	2	37226	2608·4	3	38326
2684·8	1	37235			
2683·2	1b	37258	Fourth Series		
2681·8	1	37274	2605·2	1	38373
2680·9	2	37290	2603·2	1	38402
2679·0	1	37316	2600·9	1	38436
2678·2	1	37327	2598·6	1	38470
2677·3	3	37340	2596·4	1	38503
2675·8	1	37361	2594·6	1	38530
2673·2	3	37397	2592·8	1	38556
2671·1	4	37427	2591·3	1	38579
2668·1	2	37469	2589·1	2	38612
2666·0	2	37498	2587·1	1	38641
2663·9	3	37528	2584·4	2	38682
2660·9	1	37570	2582·8	1	38703
2659·7	2	37587	2582·1	1	38716
2657·4	4	37619	2580·9	1	38734
2654·3	1	37663	2578·3	1	38773
2653·8	2	37675	2576·7	1	38797

Liveing and Dewar	Intensity and Character	Osc. Freq.	Liveing and Dewar	Intensity and Character	Osc. Freq.
2574·5	1	38830	2474·5	1	40399
2573·4	1	38847	2471·9	3	40442
2570·4	1	38892	2469·6	2	40481
2569·1	2	38912	2467·1	1	40520
2567·0	2	38944	2465·9	1	40540
2565·6	1	38965	2464·5	1	40563
2562·6	2	39011	2462·8	3n	40591
2559·6	4	39056	2461·7	1	40609
2556·4	3	39105	2460·0	1	40637
2553·4	4	39151	2459·2	1	40650
2550·3	3n	39199	2457·7	2	40675
2547·7	3	39239	2456·0	3	40703
2545·6	1	39271	2454·7	3	40725
2542·7	1	39316	2453·3	1	40748
2540·2	1	39355	2452·2	1	40766
2538·9	1	39375	2450·9	2	40788
2537·7	2	39393	2449·3	3	40815
2536·6	4	39413			
2534·1	2	39449	**Fifth Series**		
2531·4	1	39490			
2530·2	3	39510	2448·4	1	40830
2529·2	1	39526	2446·5	1	40862
2524·2	2	39604	2445·4	1	40880
2521·7	2	39643	2443·2	1	40917
2519·8	2	39673	2441·6	1	40947
2517·6	2	39708	2440·3	2	40965
2515·1	1	39747	2438·7	2	40992
2513·1	1	39779	2437·2	1	41017
2511·2	1	39809	2435·9	1	41039
2510·5	1	39820	2433·9	1n	41073
2509·8	1	39831	2433·3	1	41083
2509·1	1	39842	2431·8	1n	41108
2508·1	1	39858	2431·2	1n	41118
2506·8	1	39879	2429·7	2	41144
2505·6	1	39898	2428·1	2	41171
2505·2	1	39904	2427·0	1	41190
2504·4	1	39917	2425·7	3	41212
2504·0	1	39923	2422·4	1	41267
2503·7	1	39928	2421·6	1	41281
2503·1	2	39938	2419·8	1	41309
2501·4	2	39965	2418·0	1	41343
2499·8	1	39990	2416·2	2	41374
2498·0	2	40019	2414·8	1	41398
2496·3	2n	40046	2414·3	1	41406
2495 6	1	40057	2412·6	1n	41435
2493·8	1	40087	2412·0	1	41446
2492·3	1	40111	2410·1	1	41478
2491·1	3	40130	2409·0	1	41497
2489·3	2	40159	2407·5	1	41523
2487·2	2	40193	2406·5	1	41540
2485·8	1	40212	2405·3	1	41561
2484·9	1	40230	2404·1	1	41582
2483·7	1	40249	2403·2	1	41597
2482·6	2	40267	2402·4	2	41611
2480·7	1	40298	2399·3	2	41665
2479·3	1	40321	2398·6	1	41677
2477·6	1	40350	2398·0	1	41687

WATER—*continued.*

Liveing and Dewar	Intensity and Character	Osc. Freq.	Liveing and Dewar	Intensity and Character	Osc. Freq.
2396·3	1	41717	2360·6	1	42350
2394·8	1	41743	2357·7	1	42402
2393·5	1	41766	2356·6	1	42421
2391·6	1	41799	2355·5	2	42441
2390·7	1	41815	2354·1	1	42466
2387·0	2	41880	2351·6	1	42510
2385·7	3	41902	2347·5	1	42586
2384·3	1	41927	2345·6	1	42620
2383·0	1	41950	2342·1	1	42684
2381·9	1	41969	2337·5	2	42768
2379·6	1	42010	2332·2	1n	42865
2378·6	1	42027	2331·1	1n	42885
2376·6	1	42063	2323·8	2	43020
2375·5	1	42082	2316·2	1	43159
2374·9	1	42093	2310·1	1	43275
2373·6	1	42116	2307·5	1	43322
2372·8	1	42130	2300·8	1	43450
2371·2	1	42159	2297·0	1	43522
2368·6	1	42205	2283·6?	1	43779
2366·1	1	42249	2272·2?	1	43995
2365·1	1	42267	2268·0	1	44078

• Double:—the mean of pair.

N.B.—Intensity 1 in second series is not more than 5 in first series.
„ 1 „ third „ „ 6 in second „
„ 1 „ fourth and fifth „ „ 5 or 6 in third „

AIR (ABSORPTION).

(Telluric Fraunhofer Lines.)

Ångström, 'Recherches sur le Spectre Solaire,' Upsal, 1868.
Piazzi-Smyth, 'Madeira Spectroscopic,' 1882.
Fievez, 'Spectre Solaire,' Bruxelles, 1883.
Egoroff, 'Compt. Rend.' xcvii. 555; ci. 1143 (1885).
Hautefeuille and Chappuis, 'Compt. Rend.' xciii. 80.
Langley, 'Comp. Rend.' xcvii. 555.
Cornu, 'Ann. Chim. Phys.' (6) vii. 1, 1886; 'Compt. Rend.' xcv. 801.
Abney, 'Proc. Roy. Soc.' No. 348, 1885; 'Compt. Rend.' xcvii. 1206.

Ångström *a*	Fievez *b*	Piazzi-Smyth *c*	Cornu *d*	Intensity	Osc. Freq.
			7690·5		12999*d*
			7689·1		13002*d*
		7682·3	7683·8	1	13011*d*
		7680·7	7682·6	1	13013*d*
		7680·0	7680·1	1	13017*d*
	7699·9	7677·3	7677·6	2	13021*d*
		7676·3	7676·4	2	13023*d*
		7670·0	7671·5	4	13032*d*
	7689·4	7668·6	7670·2	4	13034*d*

AIR (ABSORPTION)—*continued.*

Ångström *a*	Fievez *b*	Piazzi-Smyth *c*	Cornu *d*	Intensity	Osc. Freq.
		7665·6	7665·6	6	13042*d*
	7683·9	7664·2	7664·5	6	13043*d*
	7679·1	7660·0	7660·0	7	13051*d*
	7678·3	7658·9	7658·9	7	13053*d*
	7668·3	7654·2	7654·7	8	13060*d*
	7667·4	7653·4	7653·6	8	13062*d*
	7662·9	7649·8	7649·7	9	13069*d*
	7662·0	7648·8	7648·4	9	13071*d*
	7657·9 ‡	7645·0	7644·7	10	13077*d*
	7657·0 ‡	7643·9	7643·5	10	13079*d*
	7652·9	7641·0	7640·2	12	13085*d*
	7651·9	7639·8	7639·0	12	13087*d*
	7648·2	7636·6	7635·8	12	13092*d*
	7647·2	7636·1	7634·7	12	13094*d*
	7643·8	7632·9	7631·6	10	13100*d*
	7643·1	7631·8	7630·4	10	13102*d*
	7639·3	7629·0	7627·5	9	13107*d*
	7638·4	7627·8	7626·2	9	13109*d*
	7631·8	7625·2	7623·6	9	13113*d*
	7631·2	7624·1	7622·4	9	13115*d*
7630·0	7628·2	7621·6	7620·2	10	13119*d*
	7623·2	7617·9	7615·4	6	13127*d*
	7622·1	7616·6	7614·2	8	13130*d*
	7620·3	7614·5	7612·5	8	13132*d*
	7619·3	7613·2	7611·2	8	13135*d*
	7617·5	7611·9	7609·7	8	13137*d*
	7616·3	7610·9	7608·5	8	13139*d*
			7607·1	9	13142*d*
			7606·0	9	13144*d*
			7604·8	9	13146*d*
			7603·6	9	13148*d*
			7602·8	9	13149*d*
			7601·5	8	13151*d*
			7600·9	8	13153*d*
	7613·4		7599·7	6	13155*d*
	7612·4		7599·4	6	13155*d*
	7611·0	7605·4	7598·1*	9 $8b_{0\cdot 9}$	13157*d*
7604·0	7609·3		7596·7	6	13160*d*
	7607·2	7600·0	7595·6	7	13162*d*
	7604·5	7598·6	7595·0	6	13163*d*
	7602·0		7594·4		13164*d*
	7601·0	7596·0	7593·7	$8b_{0\cdot 8}$	13165*d*
	†7600·1		7593·0		13166*d*
7315·1	7314·5			1	13668*b*
	7312·6			1	13671*b*
	7311·2			8	13674*b*
	7310·2			1	13676*b*
	7308·4			1	13679*b*
7307·4	7307·8			6	13680*b*
	7304·5			1	13686*b*
	7301·0			1	13693*b*
7300·4	7300·2			8	13694*b*
	7298·2			1	13698*b*
	7297·6			8	13699*b*

‡ 7644·3 Abney. * Double. † 7593·7 Abney. A, due to Oxygen, Egoroff.

AIR (ABSORPTION)—*continued.*

Ångström *a*	Fievez *b*	Piazzi-Smyth *c*	Cornu *d*	Intensity	Osc. Freq.
			6929·6	1	14427*d*
			†6928·9	8	14428*d*
			6928·5	4	14429*d*
			†6928·3	9	14429*d*
			†6928·1	5	14430*d*
			6927·7	5	14431*d*
			†6925·7	8	14435*d*
			†6923·4	8	14440*d*
			6923·2	4	14440*d*
6922·4	6922·2	6922·7	6922·3	4	14442*d*
	6921·2	6922·0	6918·0	5	14451*d*
	6917·4	6917·8	6917·1	5	14453*d*
6917·1	6916·5	6917·0	6916·5	2	14454*d*
			6914·4	2	14458*d*
	*6913·5	*6913·0	6913·1	6	14461*d*
	6912·8	6912·8	6912·2	6	14463*d*
6912·1	6912·0	6912·0			
	6908·6	6908·2	6908·4	6	14471*d*
6907·8	6907·5	6907·0	6907·5	6	14473*d*
	6904·5	6903·6	6904·0	6	14480*d*
6903·2	6903·4	6902·5	6903·0	7	14482*d*
	6901·2	6899·4	6899·8	7	14489*d*
6899·0	6899·9	6898·4	6898·9	8	14491*d*
6898·5	6897·0	6895·6	6895·9	8	14497*d*
6895·4	6896·0	6894·5	6895·0	9	14499*d*
6894·8	6893·6	6891·8	6892·3	10	14505*d*
6891·8	6892·6	6890·8	6891·3	10	14507*d*
6891·0	6890·2	6888·2	6888·9	10	14512*d*
6888·0	6889·2	6887·1	6887·9	9	14514*d*
6887·2	6886·9	6885·2	6885·7	9	14519*d*
B 6885·1	6885·9	6884·3	6884·7	8	14521*d*
6884·3	6883·9	6882·0	6882·8‡	8	14525*d*
6882·2	6880·2		†6888·0	9	145
6878·2	6877·9	6877·9	6878·9	3	14533*d*
	6877·0	6877·2	6878·0	6	14535*d*
	6876·9	6876·0	6876·6	5	14538*d*
	6875·0	6875·3	6874·5	7	14542*d*
	6873·9	6874·3	6873·6	6	14544*d*
	6873·0	6873·4	6872·7	6	14546*d*
	6872·2	6872·5	6871·8	6	14548*d*
	6871·5	6871·5	6871·2	9	14550*d*
6871·0	6871·1	6870·8	6870·2	9	14551*d*
	6870·5	6870·0	6869·8	6	14552*d*
6869·9	6869·8	6869·7	6869·0	6	14554*d*
	6869·2		6868·8		14554*d*
	6868·8	6868·9	6868·5	6	14555*d*
	6868·1	6868·0	6868·0	6	14556*d*
6867·1	6867·5	6867·5	6867·8	6	14556*d*
			6867·5	6	14557*d*
		6867·1	6867·1	12	14558*d*
			6867·0	8	14558*d*
			6866·8	4	14559*d*
		6866·7	6866·5	9	14559*d*
			6866·6	4	14559*d*
		6866·3	6866·2	9	14560*d*

B, due to Oxygen, Egoroff. * Solar, Cornu. † due to water-vapour, Cornu. ‡ 'Raie isolée.'

AIR (ABSORPTION)—*continued.*

Ångström *a*	Fievez *b*	Piazzi-Smyth *c*	Cornu *d*	Intensity	Osc. Freq.
6597·0	6596·8				15154*b*
6594·8	6593·5				15162*b*
6592·2	6592·1				15165*b*
6585·9	6586·0	6585·3		6	15179*b*
	6585·3	6584·4		1	15181*b*
6582·9	6583·0	6582·6		1	15186*b*
	6581·7	6582·1			15189*b*
6580·6	6580·0	6580·4			15193*b*
	6578·8	6579·6		2	15196*b*
	6576·1				15202*b*
	6575·0				15206*b*
6573·6	6574·1	6573·8		8	15207*b*
	6573·1	6573·1			15209*b*
		6571·6			15213*a*
	6570·7				15215*b*
6571·0	6569·9	6571·1		6	15217*b*
	6569·0	6568·5		2	15219*b*
	6568·6				15220*b*
6567·4	6567·4	6567·7		1	15222*b*
	6566·0				15226*b*
	6564·6				15229*b*
	6563·3	6563·5		5	15232*b*
	6562·5	6562·8		2	15234*b*
C (6562·1	6561·6	6561·7)			
	6560·0	6560·0		2	15240*b*
6559·8	6559·5	6559·7		4	15241*b*
6558·4	6558·0	6558·4			15244*b*
6557·6		6557·8		2	15245*ao*
	6556·8	6556·8		1	15247*b*
6556·2	6555·7	6555·8		5	15249*a*
		6554·7			15252*a*
	6554·0	6554·2		1	15253*b*
	6553·0				15256*b*
	6552·6				15257*b*
	6552·4	6552·4		2	15257*b*
6551·8	6552·0	6551·5		6	15258*b*
6550·7	6551·0	6550·8		2	15260*b*
	6547·9				15268*b*
6544·8	6546·0				15272*b*
6545·4 Fe	6545·7				15273*b*
6543·2	6542·4				15280*b*
6541·5	6541·0				15284*b*
6534·5	6535·5				15297*b*
6533·2					15302*a*
6531·7	6530·0				15309*b*
6530·0	6530·4				15309*b*
	6529·5				15310*b*
	6528·5				15313*b*
	6526·3				15318*b*
	6525·8				15319*b*
	6525·1				15321*b*
6523·1	6523·5			4	15325*b*
	6521·7			2	15329*b*
	6521·0			2	15331*b*
6518·6	6518·5			4	15337*b*

AIR (ABSORPTION)—*continued.*

Ångström *a*	Fievez *b*	Piazzi-Smyth *c*	Cornu *d*	Intensity	Osc. Freq.
	6518·0			2	15338*b*
6517·6	6517·1			4	15340*b*
	6516·8			3	15340*b*
	6516·0			2	15342*b*
6515·8	6515·4			6	15344*b*
	6514·7			2	15345*b*
	6514·3			2	15346*b*
6514·1	6513·5			5	15348*b*
	6513·0			2	15349*b*
6511·6	6512·1			1	15352*b*
6498·2 Ca	6498·0			4	15385*b*
	6497·0				15387*b*
6496·3 Ba	6496·1			4	15389*b*
	6495·4				15391*b*
6495·1	6495·1			6	15392*b*
	6494·6				15393*b*
6494·2 Fe	6494·2				15394*b*
	6493·7				15395*b*
6493·0	6493·2				15396*b*
6492·4 Ca	6492·7			4	15397*b*
	6492·2				15399*b*
	6491·7				15400*b*
6490·1 Fe	6490·2				15403*b*
6488·7	6489·4				15405*b*
6485·0	6485·8				15414*b*
	6484·4				15417*b*
	6483·2				15420*b*
6483·0	6483·0				15420*b*
			6341·3†	9	15765*d*
			6330·9	2	15793*d*
			6328·6 }	2	15797*d*
			6327·8 }	2	15799*d*
			6323·5 }	3	15809*d*
			6322·7 }	3	15811*d*
	6320·8		6319·9	3	15818*d*
			6319·0	1	15820*d*
	6319·4		6318·6 }	5	15821*d*
	6318·4		6317·9 }	5	15823*d*
	6317·0		6316·4	3	15827*d*
	6316·9		6316·2†	9	15828*d*
	6316·7		6315·2†	10	15830*d*
			6314·3†	9	15832*d*
	6314·4 }		6313·9 }	6	15833*d*
	6313·5 }		6313·1 }	6	15835*d*
	6312·0		6311·7	3	15839*d*
	6309·8 }		6309·5 }	7	15844*d*
	}		6309·1 }	3	15845*d*
	6309·1 }		6308·7 }	7	15846*d*
			6308·3†	9	15847*d*
	6305·7 }		6305·4 }	8	15855*d*
	6305·0 }		6304·6 }	8	15857*d*
	6302·0 }		6301·6 }	9	15864*d*
	6301·2 }		6300·9 }	9	15866*d*
	6298·7		6298·0 }	9	15873*d*
	6298·0		6297·3 }	9	15875*d*

† due to water-vapour, Cornu.

AIR (ABSORPTION)—*continued.*

Ångström *a*	Fievez *b*	Piazzi-Smyth *c*	Cornu *d*	Intensity	Osc. Freq.
6296·9	6297·1	6296·2	6296·6‡	8	15877*d*
			6296·1†	8	15878*d*
			6295·3	3	15880*d*
6294·2	6295·5	6295·0	6294·8	4	15881*d*
	6294·6	6294·6	6294·0	1	15883*d*
			6293·5	2	15885*d*
			6292·7	3	15887*d*
	6292·8	6292·7	6291·8	4	15889*d*
6291·8		6292·3	6291·4†	2	15890*d*
6290·3	6292·0	6291·9	6291·0	4	15891*d*
	6290·8	6290·8	6289·8‡	5	15894*d*
			6289·6		15895*d*
	6289·7	6289·6	6289·0	3	15896*d*
			6288·2		15898*d*
	6289·0	6288·5	6288·0†	2	15899*d*
			6286·7†		15902*d*
6286·7	6287·3	6286·9	6286·6*	2	15902*d*
	6285·6	6285·8	6285·0‡	1	15906*d*
6285·0	6285·4	6285·4	6284·6†	1	15907*d*
	6283·8	6284·1	6283·4	2	15910*d*
	6283·0	6283·2	6282·6‡	2	15912*d*
			6281·6	1	15915*d*
	6282·3	6282·2	6281·5	3	15915*d*
			6281·3†	8	15916*d*
	6281·5	6281·9	6280·8	1	15917*d*
6281·8	6280·8	6281·3	6280·0	4	15919*d*
			6279·8	2	15919*d*
	6280·2	6280·4	6279·5	4	15920*d*
6279·8	6280·0	6280·0	6279·2	4	15921*d*
	6279·5	6279·8	6278·7	4	15922*d*
		6279·2	6278·5‡	5	15923*d*
	6278·7	6278·9	6277·9	8	15924*d*
6278·4	6278·4	6278·4	6277·7	8	15925*d*
		6278·2	6277·5	1	15925*d*
		6278·0	6277·2	8	15926*d*
6277·1	6277·6	6277·4	6276·9	10	15927*d*
			6276·7	2	15927*d*
	6277·1		6276·4	4	15928*d*
	6277·0	6276·9	6276·2	9	15928*d*
	6276·8	6276·8			
	6276·7	6276·6	6276·1	6	15929*d*
			6275·8	4	15930*d*
	6276·2	6276·1	6275·6	6	15930*d*
6276·3	6275·9	6275·7	6275·4	7	15931*d*
5967·3	5967·8			2	16752*b*
	5966·8			4	16754*b*
	5966·4			2	16755*b*
5965·2	5965·0			2	16759*b*
	5964·5			1	16761*b*
	5964.0			2	16762*b*
	5958·0			6	16779*b*
	5957·4			6	16781*b*
5957·2	5957·0			6	16782*b*
5955·6	5956·0			6	16785*b*
	5955·5			1	16786*b*

due to Oxygen, Egoroff. * 'Raie isolée. † Due to water-vapour, Cornu. ‡ Solar, Cornu.

AIR (ABSORPTION)—*continued.*

Ångström *a*	Fievez *b*	Piazzi-Smyth *c*	Intensity	Osc. Freq.
5953·9	5954·0		1	16790*b*
5952·0	5952·4		1	16795*b*
	5951·5		6	16797*b*
5950·4	5950·3		1	16801*b*
	5949·5		1	16803*b*
	5949·0		3	16804*b*
	5948·7		3	16805*b*
5948·4	5948·2		6	16807*b*
5947·6 Fe	5947·6		1	16808*b*
	5946·8		6	16811*b*
5946·0	5946·0		1	16813*b*
5945·0	5945·0		5	16816*b*
	5944·4		4	16817*b*
	5944·0		4	16819*b*
5943·6	5943·4		4	16820*b*
	5943·0		4	16825*b*
5941·7	5941·6		6	16826*b*
	5941·3		1	16827*b*
5940·9	5940·7		6	16828*b*
5940·4	5940·0		6	16830*b*
	5939·5		1	16832*b*
	5939·0		1	16833*b*
5937·4	5937·4		1	16837*b*
	5934·5		1	16846*b*
5935·0	5934·0		1	16847*b*
	5933·4		5	16849*b*
5931·8	5932·5		1	16851*b*
5931·2	5931·2		1	16855*b*
	5930·5		2	16857*b*
	5928·7		6	16862*b*
	5928·3		4	16863*b*
	5926·7		1	16868*b*
5924·0	5926·3		4	16869*b*
5923·0	5923·6		1	16877*b*
	5922·2		5	16881*b*
5921·7	5921·9		5	16882*b*
5920·8	5920·7		1	16885*b*
	5920·4		1	16886*b*
5919·1	5919·5		1	16888*b*
5918·4	5918·0		8	16893*b*
5917·5	5917·5		8	16894*b*
	5917·0		8	16896*b*
5915·6	5915·6			16900*b*
	5915·1			16901*b*
5914·6	5914·9			16902*b*
	5914·3			16903*b*
5913·3	5913·4		10	16906*b*
5912·1	5912·3		4	16909*b*
5909·7	5910·0		4	16916*b*
5908·1	5909·1		1	16918*b*
5907·2	5908·8		1	16919*b*
	5908·0		2	16921*b*
	5907·5		1	16923*b*
	5907·3		1	16923*b*
	5906·7		1	16925*b*
	5906·2		1	16927*b*

AIR (ABSORPTION)—*continued.*

Ångstrom *a*	Fievez *b*	Piazzi-Smyth *c*	Intensity	Osc. Freq.
	5905·8		1	16928*b*
	5904·4	5904·5		16932*bc*
	5904·2	5904·1	2	16932*bc*
5902·7	5902·5	5902·9	1	16937*bc*
	5902·1	5902·3	1	16938*bc*
5901·4	5901·3	5901·0	3	16941*bc*
5900·5	5900·3	5900·4	6	16944*bc*
		5899·9	1	16945*c*
5899·1 Ti	5899·0	5898·8	9	16947*bc*
		5898·7		16948*c*
	5898·3	5898·3	2	16949*bc*
	5898·0	5898·1	2	16950*bc*
5898·1	5897·7	5897·9	3	16951*bc*
		5897·4	1	16952*c*
5897·1	5897·0	5897·2	8	16953*abc*
	5896·5	5896·6	4	16954*bc*
		5896·3	1	16955*c*
	5896·0	5895·9	4	16956*bc*
5895·5	5895·5	5895·6	4	16957*abc*
D_2 5895·1 Na	5895·0	5895·1	30	16959*a*
5895·0	5894·4	5894·4	1	16960*bc*
	5894·1	5894·1	1	16962*bc*
	5893·5	5893·6	2	16963*bc*
5892·5	5892·7 5892·2	5892·9 5892·4	3 3	16965*bc* 16966*bc*
5892·1 Ni	5892·0	5892·2	4	16967*bc*
5891·6	5891·8	5891·7	6	16968*bc*
5890·8	5891·3	5890·9	9	16970*bc*
	5890·7	5890·7	1	16971*bc*
	5890·4	5890·3	3	16972*bc*
	5889·9			16973*b*
D_1 5889·1 Na	5889·0	5889·1	30	16976*c*
	5888·5	5888·7	12	16977*bc*
	5887·4	5887·9	4	16980*bc*
5886·7		5886·9	6	16982*c*
	5886·1	5886·3	6	16984*bc*
	5885·9	5885·9	6	16985*bc*
5885·3		5885·2	3	16987*c*
	5884·8		6	16988*b*
	5884·4			16989*b*
5882·7	5882·9		5	16994*b*
	5882·5		7	16995*b*
	5881·6		1	16997*b*
5881·5	5881·4		1	16998*b*
5880·2	5880·6		1	17000*b*
	5879·5		1	17003*b*
5879·1	5879·2		1	17004*b*
	5878·3		1	17007*b*
	5878·0		1	17008*b*
	5876·5		1	17012*b*
	5876·0		1	17013*b*
	5875·5		1	17015*b*
	5874·0		1	17019*b*
5874·0	5873·6		1	17020*b*

Bromine (Absorption).

Daniell and Miller, 'Pogg. Ann.' xxviii. 386.
Roscoe and Thorpe, 'Phil. Trans.' 167, 209,
Moser, 'Pogg. Ann.' clx. p. 188.
Hasselberg, 'Mém. de l'Académie des Sc. de St. Pétersbourg,' xxvi. No. 4 (1878).

Roscoe and Thorpe *a*	Hasselberg *b*	Intensity and Character	Oscillation Frequency
6801·3			14699*a*
6777·2			14751*a*
6723·6			14869*a*
6649·1			15035*a*
6581·3			15190*a*
6526·9			15317*a*
6468·9		8	15454*a*
6455·4		4	15486*a*
6413·0		8	15589*a*
6401·0		4	15618*a*
6372·6		4	15687*a*
6350·5		8	15742*a*
6336·7		4	15776*a*
6312·1		4	15838*a*
6292·8		8	15886*a*
6275·4		4	15931*a*
6263·9		4	15960*a*
6240·2		8	16021*a*
6223·3		4	16064*a*
6190·9(b^v)	6188·5	1s	16154*b*
6169·7			16204*a*
6144·1			16271*a*
6119·0(b^v)	6117·9	$1b_{0·5}$	16341*b*
6101·4(b^v)	6098·8	2b	16392*b*
6072·2	6068·7	1b^v	16473*b*
6053·2	6047·1	1b^v	16532*b*
6027·3	6023·5	1b^v	16597*b*
6006·1(b^v)	6001·5	4b	16658*b*
5987·5(b^v)	5982·0	1b	16712*b*
5956·5(b^v)	5957·0	2b	16782*b*
5945·1(b^v)	5942·0	1b	16824*b*
5913·9(b^v)	5911·4	1b	16912*b*
5905·9		2b^v	16927*a*
5875·5		b^v	17015*a*
5870·7	5868·9	4b^v	17034*b*
5835·3(b^v)	5844·5	4b	17105*b*
	5829·0	$6b_{0·4}$	17151*b*
5797·7(b^v)	5803·4	4b	17226*b*
	5800·9	4s	17234*b*
	5791·5	2b^v	17262*b*
5762·7(b^v)	5762·0	$6b_{1·5}$	17350*b*
	5725·8	$1b_1{}^v$	17460*b*
5727·5(b^v)	5723·5	$6b_{0·4}$	17467*b*
	5698·0	2b^v	17545*b*
	5688·5	2b^v	17574*b*
5694·4(b^v)	5686·8	6b	17579*b*
	5667·1	2s	17640*b*
5660·4	5657·4	6b^v	17671*b*
	5652·0	$6b_{0·3}$	17688*b*
	5648·3	$2b_{0·2}$	17699*b*

BROMINE (ABSORPTION)—*continued.*

Roscoe and Thorpe *a*	Hasselberg *b*	Intensity and Character	Oscillation Frequency
5634·8(b^v)	5625·7	$6b_{1\cdot3}{}^v$	17770*b*
	5621·5	$8b_{0\cdot3}$	47783*b*
5624·4(b^v)	5618·5†	$8b_{0\cdot2}$	17793*b*
	5605·0	$b_{1\cdot5}$	17836*b*
	5593 5	2s	17872*b*
5592·0	5586·8	$8b_{0\cdot7}{}^v$	17894*b*
	5584·3	2s	17902*b*
5580·6	5574·2	$2b_{0\cdot4}{}^v$	17935*b*
5560·7	5557·0	$8b_1{}^v$	17990*b*
	5553·3	$2b^v$	18002*b*
5556·8	5550·4	$4b^v$	18012*b*
	5539·5	6s	18047*b*
5534·1	5529·4	$8b_1{}^v$	18080*b*
	5527·4	4n	18086*b*
	5522·3	6s	18103*b*
	5519·2*	2s	18113*b*
	5515·8*	1s	18125*b*
5510·3	5504·9	$6b_{0\cdot7}{}^v$	18160*b*
	5502·5	2b	18168*b*
5501·3	5495·8	2s	18190*b*
5483·8		b^v	18230*b*
5476·8	5480·7	$6b_{1\cdot4}{}^v$	18241*b*
	5477·9	6s	18250*b*
	5473·5	2s	18265*b*
	5469·0	2s	18280*b*
5460·1	5460·2	$8b_1{}^v$	18309*b*
	5456·8§	2s	18320*b*
	5454·3	1n	18329*b*
	5451·7	6s	18338*b*
	5449·3*	2s	18346*b*
	5445·5	6b	18358*b*
	5444·0	2s	18367*b*
5439·9	5435·8‖	$8b_{0\cdot7}{}^v$	18391*b*
	5432·4	$10b_{0\cdot2}{}^v$	18403*b*
	5421·0	2s	18441*b*
	5419·9	1s	18445*b*
5418·2	5412·1	$6b_{0\cdot5}{}^v$	18472*b*
	5412·1	8s	18472*b*
	5410·0	$6b_{0\cdot2}$	18479*b*
	5407·8*	4s	18486*b*
5403·2(b^v)	5400·6	2s	18511*b*
	5392·6	$2b_{0\cdot4}{}^v$	18538*b*
	5392·6	6s	18538*b*
5380·3	5391·0*	8s	18544*b*
	5388·3	$1b_{0\cdot1}$	18553*b*
	5384·6	$1b_{0\cdot3}$	18566*b*
	5380·2*	4s	18581*b*
	5377·4	4s	18591*b*
	5373·6	4s	18604*b*
	5370·4	$4b_{0\cdot5}{}^v$	18615*b*
5365·8	5361·6	6s	18646*b*
	5358·1	$6b_1{}^v$	18658*b*
	5356·9	2s	18662*b*
	5352·4†	$2b_{0\cdot6}$	18678*b*

§ Triple. * Double. † A mass of fine lines.

BROMINE (ABSORPTION)—*continued.*

Roscoe and Thorpe *a*	Hasselberg *b*	Intensity and Character	Oscillation Frequency
	5346·9	$2b_{0\cdot2}{}^{v}$	18696*b*
	5342·7	2s	18712*b*
5347·5(b^{v})	5342·2	$8b_{0\cdot6}$	18713*b*
5337·4	5336·1	1s	18735*b*
	5331·4	$2b^{r}$	18751*b*
	5326·7	2s	18768*b*
	5318·5	$4b_{1}{}^{v}$	18797*b*
	5318·5	4s	18797*b*
	5315·7	2s	18807*b*
	5312·5	$4b_{0\cdot2}$	18818*b*
5306·8(b^{v})	5308·4	$6b_{0\cdot2}$	18832*b*
5298·7(b^{v})	5302·2	$7b_{0\cdot8}$	18854*b*
	5301·1†	8s	18858*b*
	5289·3	$b_{1}{}^{v}$	18900*b*
5292·2	5289·3	4s	18900*b*
	5287·5	$6b_{0\cdot3}$	18907*b*
	5283·5	$6b_{0\cdot4}$	18921*b*
5274·5(b^{v})	5279·7	4b	18935*b*
	5276·1	2s	18948*b*
	5271·8	4s	18963*b*
5258·8(b^{v})	5265·7	b	18985*b*
	5259·4*	2s	19008*b*
	5256·3†	s	19019*b*
5244·1	5248·8	$6b_{0\cdot5}{}^{v}$	19046*b*
	5246·6§	s	19054*b*
	5243·2*	4s	19066*b*
	5241·9	4s	19071*b*
	5239·6	4s } 2b	19080*b*
	5237·4	4s	19088*b*
	5234·8	4n	19098*b*
	5224·1	2s	19137*b*
	5221·8	$6b_{0\cdot2}$	19145*b*
	5219·4*	2s	19154*b*
	5211·2	6s	19184*b*
	5208·0†	$6b_{0\cdot6}{}^{v}$	19196*b*

* Double. † A mass of fine lines. § Triple.

CHLORINE (ABSORPTION).

Morren, 'Pogg. Ann.' xxxvii. 165.

CHLORINE OXIDES (ABSORPTION).

Miller, 'Phil. Mag.' (3) xxvii. 81.
Gernez, 'Compt. Rend.' lxxiv. 804.

DYSPROSIUM (ABSORPTION).

Lecoq de Boisbaudran, 'Compt. Rend. cii. 1005.

7530 | 4515

Didymium Chloride (Absorption).

Bahr and Bunsen, 'Pogg. Ann.' clv. 366; 'Phil. Mag.' 412, 527.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874; 'Compt. Rend.' cv. 276 (1887).
Von Welsbach, 'Sitzunsb. Wien. Akad.' xcii. 1885.
Crookes, 'Chem. News,' liv. 27.
Schuster and Bailey, 'B. A. Report,' 1883.
H. Becquerel, 'Compt. Rend' civ. 777, 1691; cvi. 106; 'Chem. News,' liii. 77.

Bahr and Bunsen *a*	Lecoq de Boisbaudran *b*	Intensity and Character	Oscillation Frequency
	7430†	4	13455*b*
7220	ε 7360†	6 b_{18}^{v}	13583*b*
	7307†	8	13682*b*
	6894†	4n	14501*b*
δ6730	θ6792†	$7b_6$	14719*b*
	6720†	1n	14877*b*
	6363	2n	15711*b*
6280	6282	1n	15914*b*
6220	6225	3n	16060*b*
5920	5962*	$3b_3$	16768*b*
5820	5885*	$3b_4$	16987*b*
α	α 5824†	$4b_2$ b_{24}^{v}	17165*b*
	5788†	$10b_2$	17272*b*
5750	5747†	$10b_3$	17395*b*
5730	5719†	9s	17480*b*
5300	5312†	$3b_2$	18820*b*
β 5230	β 5219†	$10b_4^{v}$ b_{12}^{v}	19155*b*
5200	5205†	$9b_1$	19206*b*
5170		$3b_{\frac{2}{4}}$	19337*b*
5100	δ 5125†	$6b_{2_e}$	19506*b*
5010	5087†	$3b_1$	19652*b*
4810	γ4822*	$8b_2$	20732*b*
4760	ι4758	$5b_2$	21011*b*
4710	ζ4691*	$8b_3$	21311*b*
	4618	$1b_4$	21648*b*
4440	η4441*	$7b_6$	22511*b*
	4275†	$3b_1$	23385*b*

* 'Praseodidymium.' † 'Neodidymium;' von Welsbach.
According to Lecoq de Boisbaudran, 4698 does not belong to Praseodidymium, and there are also bands onging to Neodidymium at 4640, 4300, and 4754, 4768.

Erbium Chloride (Absorption).

Bahr and Bunsen, 'Pogg. Ann.' clv. 366; 'Phil. Mag.' 412, 527.
Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Bahr and Bunsen *a*	Lecoq de Boisbaudran *b*	Intensity and Character	Oscillation Frequency
	6985	1	14312*b*
6730	ε6837	$6b_4$	14622*b*
6600	η6670	$4b_2$	14988*b*
γ6500	β6534	$9b_4$	15300*b*
	6492	3n	15399*b*
6360	ξ6404	$5b_3$	15611*b*

ERBIUM CHLORIDE—*continued.*

Bahr and Bunsen *a*	Lecoq de Boisbaudran *b*	Intensity and Character	Oscillation Frequency
5501	5490	$1b_2$	18209*b*
β5440	5433	2n	18401*b*
5390	δ5409	7n	18482*b*
	δ5363	$7n_2$	18641*b*
	5278	1	18941*b*
α5230	α5231	$9b_2$	19111*b*
	5208	3n	19196*b*
	5189	2n	19266*b*
δ4900	4921	$4b_4$	20315*b*
	γ4874	$9b_1$	20511*b*
	4855	2n	20591*b*
4539	4515	$4b_4$	22142*b*

HOLMIUM (ABSORPTION).

Lecoq de Boisbaudran, 'Compt. Rend.' cii. 1003.

6404	5363

IODINE (ABSORPTION).

Daniell and Miller, 'Pogg. Ann.' xxviii. 386.

Morghen, 'Beiblätter,' viii. 822; 'Mem. della Soc. degli Sp. Ital. xiii. 127 (1884).

Thalén, 'Le Spectre d'absorption de la vapeur d'Iode,' Upsal, 1869. Swenska Wet. Akad. Handlingar, viii.

Morghen *a*	Thalén *a*	Intensity and Character	Oscillation Frequency
6799·4	6834·0	$3b^v$	14628*b*
	6778·0	$3b^v$	14749*b*
6741·2	6739·0	$3b^v$	14835*b*
	6724·0	$2b^v$	14868*b*
6686·0	6685·0	$3b^v$	14954*b*
	6647·5	$2b^v$	15040*b*
6638·3	6634·0	$3b^v$	15070*b*
	6594·0	$2b^v$	15161*b*
6587·5	6582·5	$2b^v$	15187*b*
6544·8	6541·0	$4b^v$	15284*b*
	6532·5	$2b^v$	15303*b*
6504·2	6503·5	$3b^v$	15372*b*
6494·7	6493·0	$4b^v$	15397*b*
6458·2	6455·0	$4b^v$	15487*b*
6448·6	6446·5	$3b^v$	15508*b*
6407·9	6407·0	$4b^v$	15603*b*
6400·6	6399·5	$3b^v$	15621*b*
6365·5	6369·5	$2b^v$	15695*b*
6559·4	6361·0	$4b^v$	15716*b*
	6354·0	$1b^v$	15733*b*
6321·7	6322·5	$3b^v$	15812*b*
6313·2	6316·0	$3b^v$	15828*b*
6274·1	6276·0	$4b^v$	15929*b*
6267·2	6271·0	$3b^v$	15942*b*
	6232·0	$5b^v$	16042*b*

IODINE (ABSORPTION)—*continued.*

Morghen *a*	Thalén *b*	Intensity and Character	Oscillation Frequency
6229·2	6227·5	2b^v	16053*b*
	6190·0	6b^v	16150*b*
6187·4	6186·5	2b^v	16160*b*
6148·6	6148·5	6b^v	16259*b*
	6147·0	1b^v	16263*b*
6108·3	6110·0	7b^v	16362*b*
6069·5	6068·0	7b^v	16475*b*
6031·6	6029·5	8b^v	16580*b*
6011·0			16631*a*
5991·4	5991·5	8b^v	16685*b*
5969·0			16748*b*
5951·8	5954·5	7b^v	16789*a*
5931·8			16853*a*
	5918·0	7b^v	16893*b*
5915·0	5916·0	1b^v	16898*b*
5898·4			16949*a*
	5883·0	6b^v	16993*b*
5879·5	5880·0	1b^v	17002*b*
5864·0			17048*a*
5848·2	5848·5	5b^v	17093*b*
5843·3	5845·5	1b^v	17102*b*
5816·5	5816·0	5b^v	17189*b*
5811·0	5811·0	1b^v	17204*b*
	5808·5	1b^v	17211*b*
5786·2	5784·0	4b^v	17284*b*
5778·5	5776·5	2b^v	17306*b*
5759·1	5772·5	2b^v	17318*b*
5749·8	5753·0	3b^v	17377*b*
5744·8	5745·0	5b^v	17401*b*
5732·3	5738·0	3b^v	17422*b*
5719·3	5721·5	2b^v	17473*b*
5713·8	5713·5	6b^v	17497*b*
5693·4	5707·5	4b^v	17516*b*
5686·2	5683·0	7b^v	17591*b*
5664·7	5675·0	5b^v	17616*b*
5656·4	5653·0	7b^v	17684*b*
5636·5	5644·0	5b^v	17713*b*
5625·4	5625·0	6b^v	17772*b*
5610·0	5614·0	6b^v	17807*b*
5597·5	5597·5	5b^v	17859*b*
5582·3	5586·0	6b^v	17897*b*
5567·0	5571·0	7b^v	17945*b*
5554·2	5558·5	7b^v	17985*b*
5540·6	5545·0	4b^v	18029*b*
5531·0	5531·5	8b^v	18073*b*
5514·8	5521·0	3b^v	18107*b*
5506·4	5505·5	8b^v	18158*b*
5488·1	5496·5	3b^v	18188*b*
5480·5	5480·0	9b^v	18243*b*
5462·3	5473·0	2b^v	18266*b*
5457·6	5455·0	7b^v	18326*b*
	5449·5	2b^v	18345*b*
5436·4	5432·0	7b^v	18404*b*
5412·0	5409·5	7b^v	18481*b*
5389·0	5388·0	6b^v	18558*b*
5366·4	5366·0	6b^v	18630*b*

IODINE ABSORPTION—*continued.*

Morghen *a*	Thalén *b*	Intensity and Character	Oscillation Frequency
5344·6	5346·0	5b^v	18700*b*
5324·4	5326·0	5b^v	18770*b*
5304·3	5307 0	5b^v	18837*b*
5284·8	5289·0	4b^v	18901*b*
5267·8	5272·0	4b^v	18962*b*
5251·3	5254·0	4b^v	19027*b*
5235·7	5239·0	4b^v	19082*b*
5219·9	5222·5	4b^v	19142*b*
5206·6	5208·0	3b^v	19196*b*
5192·7	5193·0	3b^v	19251*b*
5180·2	5181·0	3b^v	19296*b*
5165·3	5168·0	3b^v	19344*b*
5152·0	5155·0	3b^v	19393*b*
5140·6	5144·0	2b^v	19434*b*
5129·8	5132·5	2b^v	19478*b*
5120·5	5122·0	2b^v	19518*b*
5111·7	5112·0	2b^v	19556*b*
5101·8	5102·0	2b^v	19594*b*
5093·5	5093·0	1b^v	19629*b*
5086·6			19654*a*
5079·1			19683*a*
5072·0			19710*a*
5064·4			19740*a*
5057·0			19779*a*
5050·6			19794*a*
5044·8			19816*a*
5038·6			19841*a*

IODINE BROMIDE (ABSORPTION).

Gernez, 'Comp. Rend.' lxxiv. 1190.

IODINE MONOCHLORIDE (ABSORPTION).

Roscoe and Thorpe, 'Phil. Trans.' clxvii. 209.

Roscoe and Thorpe	Intensity and Character	Oscillation Frequency	Roscoe and Thorpe	Intensity and Character	Oscillation Frequency
6475·1	3b^v	15446	6112·8	3b^v	16354
6442·9	3b^v	15517	6079·2	3b^v	16444
6421·3	3b^v	15569	6071·3	3b^v	16466
6383·7	3b^v	15660	6040·9	3b^v	16549
6372·6	3b^v	15608	6033·2	3b^v	16589
6324·9	3b^v	15811	6021·3	4b^v	16603
6318·0	3b^v	15824	6005·2	8b^v	16647
6266·8	3b^v	15952	5995·9	4b^v	16673
6216·9	3b^v	15909	5974·1	4b^v	16734
6181·5	3b^v	16176	5957·3	8b^v	16781
6167·9	3b^v	16212	5944·3	4b^v	16818
6155·0	3b^v	16242	5918·7	3b^v	16890
6122·6	3b^v	16328	5905·1	3b^v	16930

IODINE MONOCHLORIDE (ABSORPTION)—*continued.*

Roscoe and Thorpe	Intensity and Character	Oscillation Frequency	Roscoe and Thorpe	Intensity and Character	Oscillation Frequency
5886·7	3b^{v}	16983	5600·7	3b^{v}	17851
5877·8	3b^{v}	17008	5590·0	3b^{v}	17884
5861·4	3b^{v}	17056	5572·0	3b^{v}	17942
5852·3	3b^{v}	17082	5561·3	3b^{v}	17976
5843·7	3b^{v}	17108	5552·9	3b^{v}	18003
5820·5	8b^{v}	17176	5535·4	3b^{v}	18060
5815·9	4b^{v}	17189	5523·6	3b^{v}	18099
5788·8	8b^{v}	17270	5508·4	3b^{v}	18149
5782·0	4b^{v}	17290	5501·3	3b^{v}	18172
5751·0	3b^{v}	17383	5482·5	3b^{v}	18234
5744·4	2b^{v}	17403	5459·5	3b^{v}	18311
5719·6	8b^{v}	17479	5435·1	3b^{v}	18394
5713·0	4b^{v}	17499	5412·1	3b^{v}	18472
5685·8	3b^{v}	17582	5394·3	3b^{v}	18533
5679·5	3b^{v}	17602	5368·1	3b^{v}	18623
5658·3	3b^{v}	17668	5349·8	3b^{v}	18687
5650·0	3b^{v}	17694	5330·0	3b^{v}	18756
5632·1	3b^{v}	17750	5315·5	3b^{v}	18807
5628·6	3b^{v}	17760	5295·0	3b^{v}	18880
5618·4	3b^{v}	17793	5276·1	3b^{v}	18948

NITROGEN PEROXIDE (ABSORPTION).

Brewster, 'Phil. Trans.' Edin. xii. 519; 'Pogg. Ann.' xxviii. 385, xxxvii. 50; 'Phil. Trans.' Lond. cl. 157 (1860).
Morren, 'Pogg. Ann.' cxli. 157.
Moser, 'Pogg. Ann.' clx. 177.
Gernez, 'Compt. Rend.' ci. 43.
Hasselberg, 'Mém. de. St. Pét.' xxvi. No. 4.
Bell, 'Am. J.' vii. 32 (1885).

Hasselberg	Intensity and Character	Oscillation Frequency	Hasselberg	Intensity and Character	Oscillation Frequency
6853·7	4s	14586	6526·0*	1s	15319
6827·5	1s	14642	6515·6	2s	15343
6808·7	2s } $b_{1·5}$	14683 }	6509·8	2s	15357
6794·0	4n }	14715 }	6502·3	$1b_{0·4}$	15375
6772·5	$2b_{0·1}$	14761	6488·5	$2b_{0·6}^{v}$	15407
6766·3	4s	14775	6474·7	$6b_{1}^{v}$	15440
6742·4	2b	14827	6468·1	$6b_{0·6}$	15456
6734·6	6n	14844	6461·0	$6b_{0·1}$	15473
6725·8	4s	14864	6454·8	$2b_{0·1}$	16488
6710·7	2s	14897	6448·2	$4b_{0·1}$	16504
6695·3	$4b_{0·6}^{v}$	14931	6438·2*	1s	15528
6689·0	2n	14945	6433·2	4s	15540
6678·3	$4b_{0·2}$	14969	6424·7	4n	15560
6658·9	2s	15013	6417·3	$4b_{2}^{v}$	15578
6558·0	1n	15244	6412·1	1s	15591
6552·7	1s	15256	6407·0	1n	15603
6546·0	1n	15272	6397·5	1s	15626

* Double.

NITROGEN PEROXIDE (ABSORPTION)— *continued.*

Hasselberg	Intensity and Character	Oscillation Frequency	Hasselberg	Intensity and Character	Oscillation Frequency
6377·7	$4b_{0\cdot2}$	15675	5984·6	4s	16705
6367·2	2n	15701	5977·5	$4b_{0\cdot1}$	16724
6360·1	$4b_{0\cdot1}$	15718	5972·6	4s	16738
6353·3	2s	15735	5969·3	2s	16747
6350·9	1n	15741	5962·2	6n	16767
6341·0	$2b_{0\cdot2}{}^{v}$	15766	5957·0	4s	16782
6334·2	$4b_{0\cdot2}$	15783	5947·5	$4b^{v}$	16809
6321·5	4s	15814	5944·8	$6b_{0\cdot1}$	16815
6316·3	$4b_{1}$	15827	5936·0	$6b_{0\cdot2}{}^{v}$	16842
6311·2	4	15840	5933·7	6n	16848
6305·1	1s	15855	5928·1	$10b_{0\cdot3}$	16864
6297·8	1s	15874	5924·4	4s	16875
6290·0	4n	15894	5920·4	$8b_{0\cdot3}$	16886
6268·7	1s	15948	5915·3	$6b_{0\cdot4}$	16900
6263·4	4s	15961	5912·6	$6b_{0\cdot1}$	16908
6259·2	2s	15972	5902·7	$6b_{1}$	16937
6255·8	4s	15982	5898·3	7s	16949
6250·7*	6s	15994	5892·2	$6b_{0\cdot5}{}^{v}$	16967
6242·3	2s	16015	5877·9	4s	17008
6236·7	6s	16029	5873·2	1n	17022
6232·3	4s	16041	5864·2	$1b_{0\cdot5}{}^{v}$	17048
6224·9	4n	16060	5859·6	$1b_{0\cdot5}$	17061
6212·2	$1b_{0\cdot6}{}^{v}$	16093	6853·9	6n	17077
6206·3	$2b_{0\cdot6}{}^{v}$	16110	5850·5	$4b_{0\cdot7}$	17087
6201·5	$6b_{0\cdot5}{}^{v}$	16121	5845·2	4s	17103
6194·8	$2b_{0\cdot2}$	16139	5840·4	1s	17117
6186·6	1s	16159	5837·0	6s	17127
6175·8	$6b_{0\cdot2}$	16188	5828·7	1n	17151
6171·8	4s	16199	5819·0	1s	17180
6165·3	$6b_{0\cdot2}{}^{v}$	16215	5814·4	$1b_{0\cdot1}{}^{v}$	17194
6164·7	$8b_{0\cdot1}$	16219	5807·5	1s	17214
6160·6	4s	16227	5803·0	$1b_{0\cdot5}$	17227
6155·5	6n	16241	5791·3	$1b_{1\cdot5}$	17262
6141·3	$6b^{v}$	16278	5789·8	8s	17267
6136·2	$4b_{0\cdot1}$	16292	5776·7	6s	17306
6126·4	$12b_{0\cdot4}$	16318	5770·2	6s	17325
6121·2	$8b_{0\cdot1}$ $b_{1\cdot7}$	16332	5768·1	1s	17332
6114·6	$6b_{0\cdot6}$	16352	5752·5	8s	17379
6110·0	2s	16362	5747·8*	6s	17393
6107·8	4s	16368	5742·6	1n	17408
6090·4*	2s	16414	5737·1	4s	17425
6084·3	4s	16431	5734·2	1s	17434
6079·2	2s	16445	5729·4	$8b_{0\cdot3}$	17449
6068·0	2b	16475	5719·8	$4b_{1}$	17478
6055·8	6s	16508	5709·2	$3b_{0\cdot5}{}^{v}$ $b_{1\cdot6}$	17510
6052·3	$4b^{r}$	16518	5708·2	$4b_{0\cdot2}$	17513
6039·4†	$2b_{0\cdot6}$	16553	5706·4	$6b_{0\cdot3}{}^{r}$	17519
6028·3†	$1b_{0\cdot8}$	16583	5699·5	$4b_{0\cdot3}{}^{r}$	17540
6023·3	4s	16597	5692·3*	1s	17562
6018·6	6s	16610	5689·3	4s	17572
6016·0	1s	16617	5689·3	$1b_{0\cdot2}{}^{r}$	17572
6013·4	$6b_{0\cdot2}$	16625	5683·8	4s	17588
6002·5	$6b_{0\cdot5}{}^{v}$	16655	5679·5	$6b_{0\cdot4}{}^{v}$ $b_{1\cdot2}$	17602
5997·1	$6b_{0\cdot2}$	16670	5670·7	$4b_{1}{}^{v}$	17630
5989·1	$4b_{0\cdot4}$	16692	5663·9	$4b_{0\cdot2}{}^{v}$	17650

* Double.

† A mass of fine lines.

NITROGEN PEROXIDE (ABSORPTION)—*continued.*

Hasselberg	Intensity and Character	Oscillation Frequency	Hasselberg	Intensity and Character	Oscillation Frequency
5653·0	$8b_{0\cdot4}{}^{v}$	17684	5384·3	$8b_{0\cdot1}$	18567
5648·1	6s	17700	5379·2	$8b_{0\cdot1}$	18585
5644·6	$10b_{0\cdot3}$	17711	5376·1	4s	18595
5642·1	$10b_{0\cdot1}$ } $1\cdot5$	17719	5363·7	$6b_{0\cdot1}$	18638
5635·7	$8b_{0\cdot2}$	17739	5360·6	$4b_{0\cdot1}$	18649
5633·0	$8b_{0\cdot2}$ }	17747	5349·1	1s	18689
5627·9*	2s	17762	5345·4	4s	18702
5624·0	4s	17776	5343·0	$6b_{0\cdot1}$	18710
5616·5	$1b_{0\cdot4}$	17799	5342·5	$1b_{1\cdot3}$ } $1b_{1\cdot3}$	18712
§5610·1	1s	17820	5339·3	$8b_{0\cdot1}$	18723
*5606·4	1s	17831	5336·0	1s	18736
5602·1	1s	17845	5334·1	$2b_{2}{}^{r}$	18742
5600·2	4s	17851	5332·4	6n } b_2	18748
5588·0	4n	17890	5325·1	6s	18773
5579 9	6n	17916	5321·6	4s	18786
5572·5	1s	17939	5312·8	$2b_{0\cdot5}{}^{r}$ } $b_{1\cdot4}$	18817
5564·6*	4s }	17965	5304·6	$6b_{0\cdot2}{}^{r}$	18846
5564·5	$1b_{0\cdot2}{}^{r}$ }	17966	5294·0	$4b_{1}{}^{r}$	18883
5557·0	4s	17990	5288·2	6s	18904
5553·5	4n	18001	5285·6	6n } $b_{2\cdot1}$	18914
5550·9	4s	18009	5279·8	$6b_{0\cdot1}$	18935
5542·8	$1b_{0\cdot4}{}^{v}$ }	18036	5277·8	4s	18942
5540·3	$1b_{0\cdot2}{}^{v}$ }	18044	5273·0	$4b_{1}{}^{v}$	18959
5537·8	$1b_{0\cdot1}$	18053	5270·7	$6b_{0\cdot3}{}^{r}$	18967
5530·5	$8b_{0\cdot3}{}^{v}$	18076	5263·6	$10b_{0\cdot5}$ } $b_{2\cdot8}$	18992
5528·2	$8b_{0\cdot1}$	18084	5259·2	8n	19009
5522·2	$6b_{0\cdot3}{}^{v}$	18103	5251·3	$12b_{0\cdot8}$	19037
5516·1	$1b_{0\cdot5}$	18123	5242·8†	$8b_{0\cdot5}{}^{v}$	19068
5502·5	4s	18168	5240·2	8s	19077
5491·5	6n	18205	5229·6	8s }	19116
5489·7	$8b_{1\cdot9}{}^{v}$ } $b_{3\cdot7}{}^{v}$	18211	5224·1	$8b_{0\cdot8}{}^{v}$ }	19137
5485·3	$4b_{0\cdot4}{}^{v}$	18225	5219·0	8s }	19155
5480·8	4n	18240	5214·8	$8b_{0\cdot7}{}^{v}$ }	19171
5476·5	4n	18254	5207·0	$10b_{0\cdot6}$	19199
5471·4	$6b_{0\cdot4}{}^{v}$	18272	5199·9	$6b_{0\cdot5}$ }	19226
5469·0	6n	18279	5199·7	10s }	19226
5465·9	4s	18290	5195·0	$10b_{0\cdot2}{}^{v}$	19244
5462·4	$8b^{r}$	18302	5190·8	$10b_{0\cdot3}{}^{v}$	19259
5451·2	8n	18339	5185·5	$4b_{0\cdot5}$	19279
5448·6	1s } b_3	18348	5178·4†	$6b_{0\cdot3}{}^{v}$	19305
5440·2	4n	18376	5176·5	4s	19312
5432·9	$2b^{v}$	18401	5172·1	$6b_{0\cdot3}$	19329
5430·3	8s }	18410	5164·0*	1s	19359
5428·5	$4b_{0\cdot4}$ }	18416	5157·1	1s }	19385
5421·8	4s	18439	5155·1	$1b_{0\cdot4}$ } $b_{0\cdot4}$	19393
5421·8	$4b_{0\cdot3}{}^{r}$ } $b_{0\cdot3}$	18439	5154·6	4s }	19394
5420·0	6s	18445	5145·0	1n	19431
5417·5	4s	18453	5137·1	$2b^{r}$	19461
5415·7	2s	18459	5124·8	$2b_{1\cdot1}$	19507
5411·6	1s	18473	5124·0	$8b_{0\cdot1}$ } $b_{1\cdot1}$	19510
5404·7	2s?	18497	5122·0	2s	19518
5399·5	4n	18515	5121·2	6s	19521
5392·5	$8b_{0\cdot2}$	18539	5119·4	4s	19528
5389·4	8s	18549	5117·5§	1s	19535
5387·0	2s	18557	5111·7	6n }	19557

* Double. † A mass of fine lines. § Triple.

NITROGEN PEROXIDE (ABSORPTION)—*continued.*

Hasselberg	Intensity and Character	Oscillation Frequency	Hasselberg	Intensity and Character	Oscillation Frequency
5103·7	$2b_{0\cdot1}$ } $b_{2\cdot2}$	19588	4856·7	1s	20584
5100·7	1s	19599	4854·7	1s	20593
5095·2	$8b_{0\cdot4}{}^{v}$ }	19620	4849·9	$2b_{0\cdot2}{}^{v}$	20613
5092·9	4s	19626	4846·9	4b	20626
5089·7	$4b_{0\cdot1}$	19641	4843·4	4n }	20641
5086·9	$2b_{0\cdot1}$	19653	4841·5	$4b_{0\cdot2}{}^{v}$ }	20649
5083·1	$4b_{0\cdot2}$	19667	4839·2	$4b_{0\cdot2}$	20658
5076·6	4s	19692	4835·8	2s	20673
5073·5	1s	12704	4831·0	$6b^{v}$	20694
5066·2	$6b_{0\cdot2}$	19733	4828·0	$2b_{2}{}^{r}$	20707
5063·6	$4b_{0\cdot2}$	19743	4820·0	2n	20741
5061·2†	$6b^{r}$	19752	4817·2	2n	20753
5050·5 }	$6b_{1\cdot2}$ } $b_{1\cdot2}$	19794	4814·3	2n	20765
5045·7	$10b_{0\cdot1}$ }	19813	4812·0	8n	20775
5042·8	4s }	19824	4810·1	6n } $b_{2\cdot5}$	20784
5041·2	6s } $b_{0\cdot4}$	19831	4807·2	4n	20796
5040·0	$1b_{0\cdot4}{}^{v}$ }	19835	4802·8	4n	20814
5035·1	1s	19855	4797·2	10n	20839
5032·0	$8s_{1}b_{0\cdot2}{}^{r}$	19867	4792·8	$8b_{0\cdot7}{}^{v}$	20859
5027·2	$10b_{0\cdot2}$ }	19886	4787·4	2s	20882
5024·1	4s }	19898	4783·6	1s	20898
5022·3	2s } b_{1}	19905	4778·8	$6b_{0\cdot1}$	20920
5020 8	1s }	19911	4775·2	$4b_{0\cdot2}$	20935
5018·8	1s }	19919	4764·8	$6b_{0\cdot1}$	20981
5009·6	$6b_{0\cdot1}$	19956	4760·3	$4b_{0\cdot2}$	21001
5003·3	1s	19981	4757·6	$4b_{0\cdot2}$	21013
5001·1	4n	19990	4753·5	6n }	21031
4998·1	2n	20002	4746·6	$8b_{0\cdot3}{}^{v}$ }	21061
4978·2	4n	20082	4744·7	4s	21070
4974·7	2s	20096	4738·4	$6b_{0\cdot5}{}^{v}$ }	21098
4965·6	10n }	20132	4736·1	$4b_{0\cdot2}{}^{v}$ }	21108
4963·8	$8b_{0\cdot3}{}^{v}$ } $b_{1\cdot1}{}^{v}$	20140	4731·1	6s	21130
4960·7	$6b_{0\cdot2}{}^{v}$ }	20152	4728·1	4s	21144
4953·9	$6b_{0\cdot1}$	20180	4721·7	$4b_{0\cdot2}{}^{v}$	21173
4946·2	$8b_{0\cdot1}$ }	20211	4718·0	6s }	21189
4944·3	6s } $b_{2\cdot2}{}^{v}$	20219	4715·7	$4b_{0\cdot4}{}^{v}$ }	21199
4941·7	$8b_{1}{}^{v}$ }	20230	4714·5	$4b_{0\cdot2}{}^{r}$	21205
4937·8	$6b^{v}$ }	20246	4710·2	$6b_{0\cdot2}$	21224
4931·3	4s } $b_{0\cdot5}{}^{v}$	20272	4708·1	4s }	21234
4929·5	$4b^{v}$ }	20280	4702·2	$4b_{0\cdot3}{}^{v}$ } b_{1}	21260
4917·8	4n }	20328	4698·5	$2b_{0\cdot2}{}^{v}$ }	21277
4915·0†	$6b_{1\cdot2}{}^{v}$ }	20340	4694·0	$4b_{0\cdot1}$	21297
4912·0	$2b_{0\cdot2}$	20352	4687·5	$4b_{0\cdot1}$	21327
4907·7	$4b_{0\cdot2}$	20370	4683·7	$4b^{v}$	21344
4903·0	$8b_{0\cdot4}$	20389	4679·7	$10b_{0\cdot5}$	21363
4896·0	$4b^{v}$ }	20419	4675·2	4n	21383
4891·5	$6b_{0\cdot5}$ }	20437	4665·3	$6b_{1}{}^{v}$	21428
4885·5	$8b_{0\cdot5}$ } $b_{2\cdot6}$	20463	4662·9	4n	21439
4882·3	$8b_{0\cdot1}$ }	20476	4659·5	2n	21455
4874·0	$1b_{0\cdot6}{}^{v}$ }	20511	4656·8	4n	21468
4867·6	2n	20538	4643·8	$10b_{0\cdot5}{}^{v}$ }	21528
4865·3	2s	20548	4640·9	$6b_{0\cdot2}$ } b_{2}	21541
4860·6	$2b_{0\cdot3}$	20568	4630·6	$6b_{1}{}^{v}$ }	21589

† A mass of fine lines.

Oxygen (Absorption).

Janssen, 'Compt. Rend.' cii. 1352 (1886); cvi. 1118 (1888).
Liveing and Dewar, 'Phil. Mag.' Sept. 1888.
See also 'Air (Absorption).'

Potassium Permanganate (Absorption).

Lecoq de Boisbaudran, 'Spectres Lumineux,' Paris, 1874.

Lecoq de Boisbaudran	Intensity and Character	Oscillation Frequency	Lecoq de Boisbaudran	Intensity and Character	Oscillation Frequency
δ5703	$7b_{12}$	17529	ε4861	$3b_7$	20565
α5465	$9b_{12}$	18293	4694	$1b_6$	21297
β5246	$9b_9$	19056	4543	$1b_6$	22005
γ5045	$7b_8$	19816			

Thulium Nitrate (Absorption).

Thalén, 'Oefvers. Kongl. Vet. Ak. Förhandl.' Stockholm, 1881, No. 6.

6840	b	4650	b

Water (Absorption).

Ångström, 'Spectre Solaire,' 38.
See also 'Air (Absorption).'

Phosphorescent Spectra.

Yttria.

Crookes, 'Phil. Trans.' 1886; 'Ann. Chim. Phys.' (6) III. p. 145.

Crookes	Intensity and Character	Oscillation Frequency	Crookes	Intensity and Character	Oscillation Frequency
6675·6	2b	14975	5491·5	$8b_1$	18205
6629·9	2b	15079	5399·5	$7b_1$	18515
6475·6	$3b_8$	15438	5373·3	$2b_1$	18605
6209·5	$1b_4$	16100	5177·8	1b	19308
6179·7	$6b_2$	16177	4932·0	4b	20279
5976·2	1b	16728	4824·7	4b[r]	20721
5790·8	$1b_8$	17264	4449·1	4b	22470
5736·9	$10b_2$	17426	4323·0	4b	23125
5670·0	$2b_2$	17631			

ERBIA.

Crookes, 'Phil. Trans.' 1886.

Crookes	Intensity and Character	Oscillation Frequency	Crookes	Intensity and Character	Oscillation Frequency
5564	4b	17967	5318	5b	18798
5450	3b	18326	5197	4b	19236

SAMARIA.

Crookes, 'Phil. Trans.' 1885, Pt. II. 691.

Crookes	Intensity and Character	Oscillation Frequency	Crookes	Intensity and Character	Oscillation Frequency
6402	$2b_6$	15615	5976	$4b_6$	16729
6093·7	10s	16405	5620	$2b_8$	17788

APPENDIX.

Cadmium.

Bell, 'Am. Jour. Science,' June, 1886 (based upon Rowland's Photographic Map of the olar Spectrum).

See also Liveing and Dewar, 'Phil. Trans.' clxxix. 231 (1888).

Spark	Intensity and Character	Oscillation Frequency	Spark	Intensity and Character	Oscillation Frequency
6438·77	10sc	15526	3249·40	5sc	30766
5379·22	10nc	18585	3084·28	7sd	32413
5338·50	10nc	18727	2979·87	7sc	33548
5086·09	10sc	19656	2880·25	7sc	34709
4800·15	6sc	20826	2836·45	7sc	35244
4678·39	7sc	21368	2748·45	9nc	36372
4414·19	5sc	22647	2572·95	9nc	38854
3611·75	9nc	27679	2329·22	7sc	42920
3609·39	10nc	27697	2321·14	9nc	43070
3534·69	4sd	28282	2312·83	10nc	43224
3466·70	8nc	28837	2288·01	9nc	43693
3465·22	10nc	28849	2264·88	9nc	44140
3402·68	10nc	29380	2264·42		44148
3260·12	7sc	30665	2193·98	8nc	45564
3251·77	5sc	30743	2143·75	8nc	46631

Carbon Hydride and Carbon Oxide.

Deslandres, 'Ann. Chim. Phys.' (6) xiv. 257 (1888).

	Wave-length	Intensity and Character	Oscillation Frequency		Wave-length	Intensity and Character	Oscillation Frequency
	*3893·1		25679	Fourth group	2631·5	4b^v	37990
Third group	3825·1	2s	26135		2599·0	6b^v	38464
	3698·7	4b^r	27028		2568·2	4b^v	38926
	3612·7	2s	27672		2556·8	2s	39099
	3492·7	6b^r	28622		2538·7	4b^v	39378
	3418·4	2s	29245		2524·1	4b^v	39606
	3305·3	8b^r	30245		2510·8	6b^v	39815
	3241·8	4b^r	30838		2492·7	4b^v	40104
	3134·6	8b^r	31892		2484·2	4b^v	40241
	3079·9	4b^r	32459		2463·3	4b^v	40583
	2976·3	10b^r	33588		2458·8	2s	40657
	2832·0	10b^r	35299		2435·0	8b^v	41054
	2792·7	10b^r	35796		2425·0	6b^v	41224
	2711·3	4b^r	36872		2407·4	8b^v	41525
	2665·1	8b^r	37511		2394·0	6b^v	41757
	2597·1	4b^r	38493		2381·5	8b^v	41976
	2489·9	2b^r	40149		2364·8	6b^v	42272
	2389·0	2b^r	41845		2356·3	4b^v	42427
	2295·2	2b^r	43554		2337·7	6b^v	42765

* Second group.

CARBON HYDRIDE AND CARBON OXIDE—*continued.*

	Wave-length	Intensity and Character	Oscillation Frequency		Wave-length	Intensity and Character	Oscillation Frequency
Fourth group	2332·5	2s	42860	Fourth group	2194·0	4s	45687
	2311·4	8b^{v}	43251		2188·1	8b^{v}	46019
	2309·7	4s	43283		2172·3	8b^{v}	46244
	2301·7	2s	43437		2161·6	8b^{v}	46499
	2286·2	8b^{v}	43727		2149·9	8b^{v}	46790
	2273·5	4b^{v}	43973		2136·5	2s	46981
	2261·6	4b^{v}	44199		2127·8	6b^{v}	41317
	2246·7	4b^{v}	44496		2112·7	8b^{v}	47847
	2237·8	4b^{v}	44673		2089·3	8b^{v}	48367
	2220·7	6b^{v}	45017		2066·8	6b^{v}	48872
	2215·3	10b^{v}	45529		2045·6		
	2195·9	2s	45562				

COBALT.

Liveing and Dewar, 'Phil. Trans.' clxxix. 231 (580 lines between 3,997 and 2,190).

COPPER.

Trowbridge and Sabine, 'Proceedings of the American Academy,' 1888; 'Phil. Mag.' (5) xxvi. 342 (based upon Rowland's Photographic Map of the Solar Spectrum).

Spark		Intensity and Character	Oscillation Frequency	Spark		Intensity and Character	Oscillation Frequency
Hartley and Adeney *a*	Trowbridge and Sabine *b*		*b*	Hartley and Adeney *a*	Trowbridge and Sabine *b*		*b*
2370·1	2369·9	9b^{r}	42182	2232·2	2231·0	3sd	44809
2368·7	2368·8	2sd	42205	2231·2	*2230·1	5sd	44829
2365·8		1		2230·0	*2228·9	5sd	44851
2357·2	2356·7	5sd	42420	2229·1	2227·8	3sd	44873
2355·0	2355·2	2sd	42447	2228·1	2226·9	3sd	44891
2346·2	2346·2	2sd	42591	2227·0	2225·7	1sd	44916
2336·6	2336·3	3sd	42790	2226·0	2224·8	1sd	44934
2303·8		1sd		2219·3	*2218·2	6sd	45067
2300·5	2299·6	1sd	43421	2218·5		3nd	
2297·5		1sd		2216·5	2215·3	3nd	45126
2295·0	*2294·4	6sd	43571	2215·8	2214·4	3sd	45145
2294·6	2293·9	3sd	43580	2214·1	2213·0	2sd	45173
2291·4	2291·1	3sd	43634	2211·3	*2210·3	6sd	45228
2286·7	2286·7	3sd	43718	2210·8		3nd	
2279·6	2278·4	2sd	43877	2208·8		2sd	
2277·0	*2276·3	6sd	43917	2200·3	2200·6	3sd	45428
2265·8	2265·5	2sd	44127	2199·8	*2199·8	1nd	45444
2263·9	*2263·9	3nd	44158	2196·5	2196·9	3sd	45504
2263·2	2263·2	3nd	44172	2192·0	*2192·4	5sd	45598
2257·7	2255·1	2sd	44330	2191·2		3nd	
2250·0	2249·0	2sd	44450	2189·6	*2189·9	5sd	45650
2248·2	*2247·0	9sd	44490	2188·5		3nd	
2247·7		3nd		2181·0	2181·8	1sd	45819
2244·0	*2242·7	9sd	44576	2179·0	*2179·5	5sd	45867
2243·5		3nd		2178·0		3nd	
2233·0	2231·7	3sd	44795	2174·5	2175·2	3sd	45958

* Also arc-lines.

COPPER—*continued.*

Spark		Intensity and Character	Oscillation Frequency	Spark		Intensity and Character	Oscillation Frequency
Hartley and Adeney *a*	Trowbridge and Sabine *b*		*b*	Hartley and Adeney *a*	Trowbridge and Sabine *b*		*b*
2148·8	*2149·2	3sd	46522		2062·7	1	48464
2135·8	*2136·1	3sd	46806		2055·1	2	48643
2134·2	2134·6	2nd	46841		2045·0	2	48863
2124·4	2126·2	3sd	47017		2037·3	2	49068
2124·0	2125·3	2nd	47037		2036·0	2	49099
2122·1	2123·1	3sd	47085		2030·9	1	49222
2121·5		2nd			2025·7	2	49349
2116·0	2117·5	2sd	47210		2016·0	1	49564
2110·5	2112·2	2sd	47328		2015·8	1	49591
2103·0	2104·9	2sd	47492		2013·2	1	49655
	2098·6	2	47630		1999·9	2	49985
	2093·9	1	47742		1989·4	2	50251
	2088·1	2	47874		1979·4	2	50505
	2085·5	2	47934		1970·4	1	50736
	2078·8	2	48088		1944·1	1	51422
	2067·0	1	48363				

* Also arc-lines.

GERMANIUM.

Kobb, 'Wied. Ann.' xxix. 670 (1886).

Spark	Intensity and Character	Oscillation Frequency	Spark	Intensity and Character	Oscillation Frequency
6336		15779	5131	b	19484
6020	10	16606	4813	b	20771
5892	10	16967	4742	b	21082
5255·5		19022	4684·5	4s	21341
5228·5		19120	4291	4b	23298
5209		19192	4260·5	4b	23470
5177·5	b	19309	4225·5		23659
5134		19472	4178	4	23928

GOLD.

Krüss [Beiblätter, xi. 704 (1887)] finds that certain lines given by Lecoq de Boisbaudran are due to impurities, viz. 5601 and 5210 to Palladium, 5230 and 4442 to Platinum, and 4345 and 4062 to Nitrogen. See also Demarçay, 'Compt. Rend.' cvi. 1226.

HYDROGEN.

Cornu, 'Jour. de Physique,' (10) v. 341 (1886).

Elementary Line Spectrum	Oscillation Frequency	Elementary Line Spectrum	Oscillation Frequency	Elementary Line Spectrum	Oscillation Frequency
4101·0	24377	3796·9	26330	3733·6	26776
3968·9	25188	3769·4	26521	3720·6	26869
3887·8	25720	3749·8	26660	3710·7	26941
3834·5	26071				

HYDROGEN. (See p. 50.)

Hasselberg, 'Bull. Acad. Imp. St. Pétersb.' xi. 203 (1884).

Compound Line Spectrum—Hasselberg		Intensity and Character	Oscillation Frequency	Compound Line Spectrum—Hasselberg		Intensity and Character	Oscillation Frequency
Eye Observation *a*	Photographic Observation *b*			Eye Observation *a*	Photographic Observation *b*		
4497·5	4497·4	3n	22228*ab*		4233·2	2	23616
	4495·9	1	22236*b*		4232·9	2	23617
	4494·3	1	22244*b*		4232·1	1	23622
4492·8	4492·6	2	22252*ab*		4226·8	1	23651
4489·7	4489·6	3	22267*ab*		4223·9	1	23668
	4488·4	1	22273*b*		4223·4	2	23670
	4486·9	2	22281*b*		*4222·0	3	23678
4485·2	4485·1	3	22289*ab*		4221·6	3	23680
	4481·0	1	22310*b*		*4211·8	4	23735
	4479·2	1	22319*b*		4211·3	1	23738
	4477·8	1	22326*b*		4209·5	2½	23748
4476·6	4476·1	2	22333*ab*		4208·5	2	23754
	4474·9	1	22340*b*		4205·5	1½	23771
4473·7	4473·3	2	22347*ab*		*4204·4	6	23777
	4470·9	1	22360*b*		*4199·2	3½	23807
4466·6	4466·2	2	22383*ab*		4197·7	2	23815
	4463·1	1	22399*b*		*4195·0	3½	23831
*4460·6	4460·3	3	22413*ab*		4181·5	3	23907
4458·6	4458·2	1	22423*ab*		4179·5	3	23919
4456·4	4456·1	2	22434*ab*		4179·0	2	23922
4455·3	4454·9	2	22441*b*		4177·1	2½	23933
	4453·7	1	22447*b*		*4176·5	6	23937
4452·6	4452·2	1	22453*ab*		4174·5	3	23948
4450·3	4450·1	1	22464*ab*		*4170·7	4	23970
4449·2	4449·1	2	22470*ab*		4166·9	1	23992
*4447·2	4447·0	3	22480*ab*		4164·6	1½	24005
4444·7	4444·6	2	22492*ab*		4163·0	1½	24014
4443·6	4443·5	1	22498*ab*		*4161·3	2½	24024
	4442·2	1	22505*b*		4158·7	2	24039
	4440·7	1	22512*b*		*4155·9	3	24055
	4425·2	1	22591*b*		4145·4	1	24116
	4422·6	1	22604*b*		4144·8	1	24120
	4422·0	1	22608*b*		4109·4	1	24327
	4419·6	1	22620*b*		4108·7	1	24331
	4418·7	1	22624*b*		4107·3	1	24340
4416·8	4416·7	2	22634*ab*		4107·1	1	24341
*4411·7	4411·7	3	22660*ab*		4105·6	1	24350
	4409·9	1	22670*b*		*4101·2	8	24376
	4400·2	2	22720		4096·9	1½	24402
	4390·3	2	22771		4095·9	1	24407
	4388·5	1½	22780		4095·4	1	24410
	4386·8	1	22789		4094·9	1	24413
	4378·8	2	22831		4087·2	2⅓	24459
	4347·1	5	22997		4084·7	1½	24474
	*4340·1	10	23034		4082·4	1	24488
	4338·3	3	23044		4081·8	1½	24492
	4242·7	2	23563		4080·9	1	24497
	4235·9	2	23600		4077·3	5	24519

* Vogel 4459, 4418, 4413, 4340, 4220, 4210, 4201, 4195, 4193, 4174, 4168, 4158 ? 4152 ? 4101, 4067, 4065, 4060.

HYDROGEN—*continued.*

Compound Line Spectrum—Hasselberg		Intensity and Character	Oscillation Frequency	Compound Line Spectrum—Hasselberg		Intensity and Character	Oscillation Frequency
Eye Observation *a*	Photographic Observation *b*			Eye Observation *a*	Photographic Observation *b*		
	4073·6	1	24541		*4066·4	3½	24584
	4072·4	1	24548		4064·7	1	24595
	4070·7	1½	24559		4063·2	2	24604
	*4069·2	4	24568		*4062·1	3	24612

* Vogel 4459, 4448, 4413, 4340, 4220, 4210, 4201, 4195, 4193, 4174, 4168, 4158? 4152? 4101, 4067, 4065, 4060.

NICKEL.

Liveing and Dewar, 'Phil. Trans,' clxxix. 231 (480 lines between 3858 and 2174).

NITROGEN.

Hasselberg, 'Mém. Acad. St. Pétersb.' xxxii. No. 15 (1885).

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
6621·8	*6622·4	4	15096	6542·3	*6543·4	4	15278
	6618·7	1½	15104		6539·8	1	15287
	6615·7	1	15111		6536·0	1	15295
6614·2	6612·9	3b^r	15118	6533·8	6533·4	3	15302
	6606·7	2	15132		6527·7	2½	15315
	6603·9	1½	15138		6524·9	2	15321
	6601·4	1½	15144		6522·0	1½	15328
	6598·7	1½	15150		6519·9	1½	15333
	6595·4	1½	15158		6516·6	2	15341
6594·7	6593·1	3	15163	6516·3	6514·4	3	15346
	6590·6	1½	15169		6512·6	2	15350
	6587·4	2b	15176		6509·3	2½b	15358
	6583·0		15186		6505·3		15368
	6580·1	2½	15193		6501·7	2	15376
	6577·3	1½	15199		6499·1	1½	15382
	6574·7	1½	15204		6496·4	1½	15389
	6571·9	2	15212		6493·7	2½	15395
	6569·1	1	15218		6490·2	1½	15403
	6566·5	1	15224		6488·1	2	15408
	6558·8	1	15242		6485·7	1	15414
	6555·2	1½	15251		6482·9	1b	15420
	6551·9	1	15258		6480·0		15428
	6548·2	1½	15267		6477·5	1½	15434

* Denotes the chief lines whose wave-lengths were first determined.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	6474·1	1½	15442	6294·9	6294·8	3	15881
	6470·8	1½	15450		6293·2	2	15885
6465·5	*6467·3	3	15458		6290·7	1	15892
	6464·4	2	15465	*e*	6285·0	1	15906
	6460·3	1	15475		6283·2	2	15911
6458·6	6457·5	4	15481		6281·0	1½	15916
	6452·4	1½ br	15494		6278·3	1½	15923
	6441·5	1	15520		6275·8	2	15932
6440·6	6439·5	2½	15525		6273·3	1½	15936
	6437·4	1½	15530		6270·9	2	15942
	6434·3	1	15537		6268·2	1	15949
c	6429·4	1	15549	6249·2	*6251·6	2	15991
	6427·1	1	15555		6248·3	1	16000
	6423·5	1	15563		6244·9	1	16008
	6422·2	1	15566	6242·6	6242·2	3	16015
	6419·5	1½	15573		6236·5	1½	16030
	6417·1	1	15579		6231·4	1	16043
	6414·4	1½	15585		6229·8	1	16047
	6409·1	1	15598		6227·8	1	16052
	6403·3	1	15612	6225·5	6225·7	2	16058
	6400·6	1	15619		6224·3	2	16061
	6397·5	1	15627	*f*	6221·6	1	16068
					6219·3	1	16074
6392·5	*6393·2	3	15637		6217·8	1	16078
	6390·0	1½	15645		6216·4	1	16082
	6385·8	1	15655		6214·4	1½	16087
6384·8	6383·5	4	15659		6211·6	1	16094
	6378·3	1½	15673		6209·3	1	16100
	6371·1	1	15691		6207·3	1½	16105
	6369·9	1	15694		6204·7	1	16112
6366·8	6367·8	3	15699		6202·4	1½	16118
	6365·9	1½	15704				
d	6363·6	1	15710	6183·2	6184·6	2	16165
	6358·1	1	15723		6178·1	1	16181
	6356·1	1½	15728	*g* 6175·1	*6174·3	3	16191
	6354·0	1	15733		6168·5	1	16207
	6350·9	1	15741	6158·2	6157·2	2	16236
	6348·5	2	15747	6125·4	*6126·0	4br	16319
	6345·7	1	15754	6118·8	6118·7	3br	16339
	6343·0	2	15761		6114·1	2	16351
	6338·0	1	15773		6110·6	1	16360
	6326·3	1	15802	*h*	6107·9	1	16367
6321·0	*6321·4	4	15815	6102·1	6101·2	2	16385
	6318·0	2	15823		6099·1	1½	16391
	6314·2	1	15833		6082·9	1½	16435
6313·8	6311·6	4br	15839		6077·9	1	16448
	6305·8	1½	15854	6066·3	*6068·3	5	16474
e	6302·3	1	15862	6060·6	6060·9	4	16494
	6300·3	1	15867	*i*	6058·6	1	16501
	6298·5	1	15872		6056·0	3	16508
	6296·7	1	15877		6053·2	2	16515

* Denotes the chief lines whose wave-lengths were first determined.

NITROGEN—*continued.*

itive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
gström Thalén	Hasselberg			Ångström and Thalén	Hasselberg		
a	*b*		*b*	*a*	*b*		*b*
	6050·4	2	16523		5910·1	1	16915
	6048·3	1	16529		5907·4	1	16923
	6045·5	1	16536	5904·6	*5904·6	5	16931
6043·3	6043·9	3	16541	5897·5	5897·5	4	16951
	6041·9	2	16546		5893·0	3	16964
	6040·0	1	16551		5890·6	2s	16971
	6036·7	1	16560		5888·3	2	16978
	6034·9	1	16565		5886·8	1	16982
	6032·1	1	16573		5884·7	1	16988
	6029·2	1	16581		5883·5	1	16992
	6026·3	2	16589		5882·0	3	16996
	6021·2	2	16603	5882·5	5880·7	2s	17000
	6017·4	1	16613	*m*	5878·2	1	17007
	6014·9	1	16620		5875·6	1s	17015
6011·8	*6012·4	5	16627		5873·9	2s	17019
6004·6	6005·1	4	16648		5870·8	2s	17028
	6000·3	3	16661		5868·8	1	17034
	5997·6	2	16668		5866·3	2n	17042
	5995·1	2	16675		5863·7	1	17050
	5993·1	1	16681		5861·3	2n	17056
	5991·7	1	16685		5858·1	2	17065
	5990·3	1	16689		5855·5	1	17073
	5988·7	3	16693	5853·0	*5853·1	5	17080
5987·8	5986·6	2	16699	5846·1	5845·9	4	17101
	5984·6	1	16705		5841·3	2	17114
	5981·5	1	16713		5839·4	2	17120
	5979·9	2	16718		5838·2	1	17124
	5977·0	2	16726		5836·6	1½	17128
	5974·4	1	16733		5835·2	1	17132
	5971·5	1½	16741		5833·7	1	17137
	5969·1	1	16748		5832·4	1	17141
	5966·8	1½	16754		5830·7	3	17146
	5963·2	1	16764	5830·5	5829·5	3	17149
	5960·9	1	16771	*n*	5828·0	1	17154
5957·3	*5957·9	5	16779		5827·0	1	17156
5950·5	5950·6	4	16800		5825·7	1	17160
	5946·0	3	16813		5824·7	1	17163
	5943·4	2	16820		5822·7	2n	17169
	5940·9	2	16828		5821·0	1	17174
	5939·1	1	16833		5819·8	1½	17178
	5937·8	1	16836		5818·1	1	17183
	5936·4	1	16840		5815·9	1½n	17189
	5934·6	3	16846		5813·2	1	17197
5933·3	5933·1	2	16850		5810·8	1½n	17204
	5930·7	1	16857		5807·4	1	17214
	5928·0	1	16864		5805·0	1	17221
	5926·1	2	16870	5801·8	*5802·9	5	17228
	5923·4	2	16877	5795·3	5795·7	4	17249
	5920·9	1	16884		5792·2	1	17260
	5918·1	2n	16892		5791·3	2	17262
	5913·4	2n	16906		5789·9	2	17266

* Denotes the chief lines whose wave-lengths were first determined.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	5788·6	1	17270	5682·5	5684·7	2	17586
	5787·1	1	17275		5681·6	1½	17595
	5785·8	1	17279		5678·8	1	17604
	5784·1	1	17284		5671·8	1	17626
	5782·8	1	17288	5657·9	*5659·2	3	17665
5780·6	5780·9	3	17293		5652·0	1	17688
	5779·9	3	17296	5637·2	5638·1	1	17731
	5778·7	1	17300	5612·6	*5613·8	3	17808
	5777·5	1	17303		5606·3	1½	17832
	5776·1	1	17308		5602·1		17845
	5775·0	1	17311		5596·0		17864
	†5773·0	1	17317	5594·2	5593·2	1½	17873
	5771·4	1	17322		5591·0	2	17880
	5770·2	1	17325		5586·0	1	17897
	5768·6	1	17330	5567·9	*5569·0	3½	17951
	5766·7	2	17336		5567·1	1	17957
	5764·1	1	17344	5563·0	5561·8	2½	17975
	5761·9	2	17350		5560·0	1	17980
	5758·5	1	17361		5557·2	1	17989
	5756·4	1	17367		5555·4	1	17995
5752·0	*5753·8	5	17375	5551·8	5552·1	3	18006
5745·6	5746·4	4	17397		5549·3	1½	18015
	5743·0	1	17407		5547·2	1½	18022
	5742·0	1	17410		5545·5	1½	18027
	5740·6	1	17415		5543·5	1	18034
	5739·6	1	17417		5542·0	1	18039
	5738·1	1	17422		5535·1	1	18061
	5736·7	1	17426		5531·3	1n	18074
	5735·0	1	17432	5525·2	5525·4	4s	18093
5730·7	5733·6	1	17436		5523·5	1	18099
	†5731·5	3	17442		5522·0	1	18104
	5729·7	1	17448	5518·7	5518·1	3	18117
	†5726·2	1	17458		5515·9	1	18124
	†5724·5	1	17464	5513·4	*5514·3	4	18129
	5722·6	1	17469		5509·5	2	18145
	5721·3	1	17473		5507·9	2	18150
	5719·9	1	17478	5506·0	5506·3	2½	18156
	5718·0	2	17483		5504·6	1½	18161
	5715·5	1	17488		5502·8	1½	18167
	5713·6	2	17497		5500·9	1½	18173
	5710·0	1	17508		5498·8	1½	18180
	5707·9	1	17514		5496·6	1½	18188
5703·8	*5706·3	3	17519		5494·7	2	18194
	5703·9	1	17527	5493·7	5493·6	2	18198
	5702·3	1	17532		5491·6	1½ b^r	18204
	5700·2	1	17538	5482·8	5483·3	2½ b^r	18232
	5698·1	1½	17544		5479·8	1	18244
	5695·5	1½	17552	5476·9	*5477·5	4	18251
	5693·0	1½	17560		5476·2	2	18255
	5690·3	1½	17569	5472·6	5472·2	2½	18269
	5687·5	1n	17577		5471·4	1½	18272

† Double.

* Denotes the chief lines whose wave-lengths were first determined.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	5469·3	1½	18279	5353·2	5352·8	4	18676
	5464·3	2	18295		5350·8		18683
v	5457·4	2	18318	*y*	5349·4		18688
	5455·5	1½	18325		5347·7		18694
	5453·1	1½	18334		5346·2		18699·
	5451·3	1½	18339		5345·0		18703
	5448·6	1½	18348		5342·9		18711
	5445·8	1	18359		5340·9		18718
	5443·7	1	18365	5339·7	*5338·6	4	18726
5441·9	*5441·2	4	18373		5337·2	1½	18731
5437·0	5436·0	3½	18390		5335·5	1½	18737
	5434·1	2	18397		5333·4	br	18744
	5432·5	3	18402		5327·4		18765
	5428·6	1½	18416		5326·7	1	18768
	5427·9	2	18418	*z*	5324·5	1½	18775
	5426·2	1	18424		5322·2	1½	18784
	5424·2	1	18430		5320·0	1½	18791
w 5422·1	5421·7	4	18439		5316·8	1	18803
	5419·8	1½	18445		5313·7	1	18814
	5417·7	1½	18453		5309·4		18829
	5415·9	1½	18459		5306·9		18838
	5413·0	1	18469	5306·3	*5305·8	4	18842
	5411·6	1	18473		5303·9		18848
	5410·1	1	18478		5302·0		18855
5406·4	*5406·2	5	18491		5300·2		18862
	5403·6	1	18501		5298·2		18869
5401·7	5401·0	3	18509	*a'*	5296·2	Weak but Sharp Lines	18876
	5399·2	2	18516		5294·1		18883
	5397·5	3	18522		5287·4		18907
	5393·9	1½	18534		5284·4		18918
	5393·0	1½	18537		5281·5		18928
	5391·4	1½	18543		5278·2		18940
	5389·7	1	18548	5273·8	*†5274·0	3	18955
x	5388·4	1	18553	*b'*	5268·4		18975
5487 4	5387·1	4	18557	5256·3	5256·0		19020
	5385.2	1½	18564	5244·6	*†5243·1	4	19067
	5383·2	1½	18571	5239·3	5237·8	2	19086
	5381·7	1½	18576	*c'*	5234·5	1½	19099
	5380·2	1	18581		5232·2	1½	19107
	5378·3	1	18588	5226·5	5225·6	1½	19131
	5375·8	1	18596	5213·1	*†5212·7	4½	19178
	5373·7	1	18604		5210·8	1	19185
5371·7	*5371·6	5	18611		5209·3	1	19191
5366·7	5366·4	3	18629	5207·7	5207·8	3	19196
	5364·6	2	18635		5205·3	1½	19206
	5362·9	3	18641		5204·0	2½	19210
	5359·4		18653		5201·8	2	19219
y	5357·4		18664	*d'*	5200·2	1s	19224
	5355·7		18667		5198·6	1s	19231
	5354·3		18671		5197 1	1s	19236

* Denotes the chief lines whose wave-lengths were first determined.
† Groups *a* to *k'* by eye observation. Groups *a* to *o* recorded by photography.

NITROGEN—*continued.*

Positive Band Spectrum				Positive Band Spectrum			
Ångström and Thalén *a*	Hasselberg *b*	Intensity and Character	Oscillation Frequency *b*	Ångström and Thalén *a*	Hasselberg *b*	Intensity and Character	Oscillation Frequency *b*
d'' 5196·1	5195·5	4	19242		5071·8	2	19711
	5191·2	Weak but Sharp Lines	19258		*5068·3	2½	19725
	5189·7		19263		5066·9 ‡	3	19730
	5188·4		19268	5065·6	5065·3 ‡	4	19736
	5186·6		19275		5063·7	2	19743
	5185·2		19280		5062·4	2	19748
5183·4	*5183·5	5	19286		5060·9	2	19754
	5181·7	2	19293		5059·7	2	19758
	5180·5	2	19298		5058·7	2	19762
	5178·9	3	19304		5057·0	2	19769
5179·3	5177·9	4	19307	*i'*	5055·5	3s	19775
	5176·5	2	19312		5053·6	3s	19782
	5174·8	3	19319		5051·7	1	19789
	5173·0	1s	19326		5049·5	1	19798
	5171·6	1s	19331		5047·3	1	19807
e'	5170·2	1s	19336		5044·8	1	19816
	5169·1	1s	19340		5042·6	1	19825
	5168·0	1s	19344		5040·0	1	19835
5165·8	5166·5	4	19350		5037·1	1	19847
	5164·7		19357		5034·3	1	19858
	5162·5	Weak but Sharp Lines	19365	5032·0	5030·8	3n	19872
	5161·3		19369		*4975·7	2½	20092
	5159·9		19375		4974·0 ‡	3½	20098
	5158·5		19380	4972·0	4972·2 ‡	4½	20106
	5157·1		19385		4970·2	2	20114
	5155·9		19390		4969·1	2	20118
5153·7	*5154·5	5	19395		4967·8	2	20124
	5153·1	1½	19400		4966·5	2	20129
	5151·6	2½	19406		4965·2	2	20134
5149·0	5149·4	3	19414		4963·8	b	20139
	5148·4	3½	19418		4960·8		20152
f'	5147·1	1	10423	*k'*	4959·5	2½	20157
	5145·8	3	19428		4957·5	3	20165
	5144·1	1½	19434		4955·3	2½	20174
	5142·4	1	19440		4953·4	2½	20182
5138·7	5137·8	3	19458		4950·9	2	20192
	5134·6	1½	19470		4947·8	2	20205
5126·1	*5126·1	4	19502		4945·6	2	20214
	5124·7	1	19508		4943·8	1½	20221
	5123·1	2	19514		4940·8	1½	20234
	5121·2	2½	19521		4937·7	1½	20246
g'	5120·6	2½	19523		4934·5	1½	20259
	5117·9	2	19534		4931·1	1	20273
	5110·1	1½	19563	4919·0	4917·5	3	20329
	5106·7	1½	19576		4916·7 ‡	4	20333
	5100·9	2	19598		*4915·7	5	20337
5097·7	*5098·7	3	19607		4914·7	2	20341
	5093·5	1	19627		4913·8	2	20345
	5090·3	1	19639	*a*	4913·0	2	20348
h'	5083·5	1	19666		4911·9	2	20353
	5076·8	2	19692		4910·7	2	20358

* Chief lines first determined. Groups *a* to *k'* by eye observation. Groups *a* to *o* recorded by photography.
‡ Strong triplets.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	4909·8	2	20361	4800·7	4800·8	4	20824
	4909·1	2	20364	4899·2	4799·2	$3\frac{1}{2}$	20831
	4908·3	2	20367		4798·4	$2\frac{1}{2}$	20834
	4907·2	3	20372	4897·3	4797·2	$2\frac{1}{2}$	20839
	4905·7	3	20378		4796·2	$2\frac{1}{2}$	20844
	4903·9	3	20386	4895·3	4795·3	$2\frac{1}{2}$	20848
	4902·0	1	20394		4794·9	$2\frac{1}{2}$	20850
	4900·2	2	20401	4893·6	4793·4	$2\frac{1}{2}$	20856
	4898·6	2	20408		4792·7	2	20859
	4897·6	2	20412	4891·1	4791·3	3	20865
	4896·2	2	20418		4790·1	2	20870
	4895·0	2	20423	4888·7	4788·8	3	20876
	4893·8	2	20428		4787·8	2	20880
	4892·6	2	20433	4886·1	4786·2	3	20887
	4891·3	3	20438		4785·0	2	20892
	4889·9	$1\frac{1}{2}$	20444		4783·8	2	20898
	4888·5	3	20450		4783·3	2	20900
	4887·1		20456		4782·3	2	20904
	4885·9		20461		4781·1	2	20909
	4885·1		20465		4780·3	2	20913
	4884·1		20469		4779·3	2	20917
	4882·7		20475		4778·3	1	20922
	4882·0		20478		4777·2	$1\frac{1}{2}$	20926
	4881·0		20482		4776·2	1	20931
	4880·0		20485		4772·8	1	20946
	4878·8	Weak Lines	20491		4771·9	$1\frac{1}{2}$	20950
	4877·7		20496		4770·7	$1\frac{1}{2}$	20955
	4876·7		20500		4769·7	$1\frac{1}{2}$	20960
	4875·4	$1\frac{1}{2}$	20505		4768·7	$1\frac{1}{2}$	20964
	4874·3	$1\frac{1}{2}$	20510		4767·4	$1\frac{1}{2}$	20970
	4873·5	$1\frac{1}{2}$	20513		4766·3	$1\frac{1}{2}$	20974
	4872·0	1	20520		4765·4	$1\frac{1}{2}$	20978
	4870·9	1	20524		4763·7	$1\frac{1}{2}$	20986
	4869·8	1	20529		4762·8	$1\frac{1}{2}$	20989
	4868·1	2	20536		4759·9	1	21003
	4866·6	1	20542		4759·0	$1\frac{1}{2}$	21007
	4865·1	1	20549		4758·2	2	21010
4814·0	*4814·0	4	20767		4756·3	2	21019
4813·0	4813·0 ‡	5	20771		4755·4	$1\frac{1}{2}$	21022
4811·7	4812·0	6	20775		4754·5	1	21026
	4811·2	3	20779		4752·3		21036
4810·4	4810·4	3	20782		4751·3		21041
4809·3	4809·4	$3\frac{1}{2}$	20787		4750·5		21044
4808·2	4808·5	$3\frac{1}{2}$	20790		4748·2		21054
4807·2	4807·4	$3\frac{1}{2}$	20795		4747·4		21058
	4806·4	$2\frac{1}{2}$	20800		4746·4		21062
	4805·8	$2\frac{1}{2}$	20802		4743·9		21074
	4805·1	$2\frac{1}{2}$	20805		4743·1		21077
	4804·2	$2\frac{1}{2}$	20809		4742·3		21081
4803·7	4803·8	$2\frac{1}{2}$	20811		4739·7		21092
4802·4	4802·6	4	20816		4738·9		21096

Very Weak Triplets

* Chief lines first determined. Groups *a* to *b'* by eye observation. Groups *a* to *o* recorded by photography.
‡ Strong triplets.

NITROGEN—*continued.*

	Positive Band Spectrum		Intensity and Character	Oscillation Frequency		Positive Band Spectrum		Intensity and Character	Oscillation Frequency
	Ångström and Thalén	Hasselberg				Ångström and Thalén	Hasselberg		
	a	*b*		*b*		*a*	*b*		*b*
		4738·1	Very Weak Triplets	21099			4676·6	Weak Lines	21377
		4735·5		21111			4675·2		21383
α		4734·7		21114			4674·3		21387
		4733·8		21118			4673·2		21392
		4730·8		21132			4671·7		21399
		4729·8		21136			4670·9		21403
		4728·9		21140			4669·9		21407
		4725·9		21154			4668·1		21416
	4722·7	*4722·7	4 ‡	21168			4667·3		21419
	4722·0						4665·8	2	21426
	4721·5	4721·6	5	21173		4666·0	4665·2	3	21429
	4720·2	4720·4	6	21178			*4664·4	4	21433
		4719·4	3	21183	β		4663·8	2	21435
	4718·4	4718·4	3½	21187			4663·1	3	21439
	4717·2	4717·3	3½	21192			4662·4	2	21442
	4716·0	4716·3	3½	21197			4661·6	2	21445
		4715·1	3½	21202			4660·8	2	21449
		4714·1	2	20207			4659·8	2	21454
		4713·4	2	21210			4659·3	1½	21456
		4712·8	2	21212			4658·7	1½	21459
		4711·7	3br	21217			4658·0	2	21462
	4709·9	4710·0	4	21225			4657·4	1	21465
		4709·2	1	21229			4656·6	3	21468
	4708·2	4708·3	4	21233			4656·0	1	21471
	4706·3	4706·6	3	21240			4655·1	2½	21475
		4706·1	1½	21243			4653·8	2	21481
	4704·5	4704·7	3	21249			4653·0	1½	21485
		4703·8	2	21253			†4652·2	2	21489
		4703·0	2	21257			4651·1	2	21494
β	4702·7	4702·5	2	21259			4650·6	2	21496
		4701·5	2	21267			4650·0	2	21499
	4700·9	4700·9	2	21266		4649·0	*4648·6	4 ‡	21505
		4700·2	2	21269		4648·6			
	4698·8	4698·9	3	21275		4647·2	4647·3	5	21511
		4697·8	1½	21280		4645·7	4645·9	6	21518
	4696·2	4696·4	3	21287		4644·8	4644·7	3	21523
		4695·5	1½	21291		4644·0	4644·1	3½br	21526
	4693·7	*4693·6	3	21299		4642·8	4642·9	4	21532
		4692·5	1	21305		4641·8	4641·8	3	21537
	4691·0	4690·9	2½	21312		4640·7	4640·8	4	21542
		4689·6	2	21317		4639·6	4639·7	4	21547
		4688·4		21323	γ	4638·2	4638·4	4	21553
		4685·6		21336			4637·3	2½	21558
		4684·8		21339			4636·6	3½	21561
		4683·8	Weak Lines	21344			4636·0	2½	21564
		4682·7		21349			4635·0	3½	21568
		4681·7		21353			4634·5	2½	21571
		4680·6		21358		4632·9	4633·1	4	21577
		4679·6		21363		4631·3	4631·4	4	21585
		4678·5		21368			4630·9	2½	21588
		4677·5		21373		4629·6	4629·7	3	21593

* Chief lines first determined. Groups a to o recorded by photography. † Double. ‡ Strong Triplets.

NITROGEN —*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén	Hasselberg			Ångström and Thalén	Hasselberg		
a	*b*		*b*	*a*	*b*		*b*
	4628·8	2½	21597		4564·5	3½	21901
4627·5	4627·7	3	21602		4563·1	4	21908
	4626·7	2	21607		4561·7	4	21915
	4625·8	2	21612		4560·3	3½	21922
	4625·2	1½	21614		4559·4	1½	21926
	4624·3	2	21618		†4558·6	2½	21930
	4623·7	1½	21621		4557·5	2	21935
	4623·1	1	21624		4557·0	2	21938
	4622·5	1	21627		4556·4	2	21940
4621·5	4621·9	3	21630		4555·5	2½	21945
	4620·7	2	21635		4554·5	2	21950
4619·2	*4619·2	3	21642		4553·3	3½	21955
	4618·0	2	21648		4552·3	2	21960
4616·7	4616·7	2½	21654		*4551·1	3½	21966
	4615·5	1½	21660		4550·0	2	21971
4614·0	4614·1	2½	21666		4548·8	2½n	21977
	4612·8	1½	21672		4547·6	2	21983
4611·4	4611·5	2	21678		4546·7	2	21987
γ	4611·1	2	21680		4546·0	1½	21991
	4610·0	1	21686		4545·2	2	21994
4608·7	4608·8	2	21691		4544·3	1½	21998
	4608·2	2	21694		4543·4	1½	22003
	4607·3	2	21698		4542·7	1½	22007
	4606·1	2	21704		4541·7	2	22011
	4605·1	1	21708		4540·8		22016
	4604·2	2	21713		4540·0		22020
	4603·0	1	21718	δ	4539·1		22024
	4602·2	2	21722		4538·0		22029
	4601·1	1½	21727		4537·1		22034
	4600·0	1½	21733		4536·2		22039
	†*4599·0	2½	21739		4535·0		22044
	4597·8		21743		4534·2		22048
	4596·7		21748		4533·5		22052
	4596·0	Weak Lines	21752		4532·0		22059
	4595·3		21755		4531·2		22063
	4594·4		21759		4530·4		22066
	4593·6		21763		4528·8		22075
	4592·3		21769		4528·1		22078
	4591·2		21774		4527·4		22081
	4590·2		21779		4525·5		22091
4574·0	*4573·5	4	21858		4524·9		22094
	4572·8 ‡	5	21862		4524·2		22097
	4572·0	6	21866		4522·2		22107
	4570·7	3	21871		4521·6		22110
	4570·1	3	21875		4520·9		22113
δ	4569·2	3	21879		4518·9		22123
	4568·3	3	21883		4518·3		22126
	4567·5	3	21888		4517·7		22129
	4566·6	2½	21891		4515·3	2	22140
	4566·0	2½	21894		4514·6	1	22144
	4565·4	2½	21897		4514·0	1	22147

* Chief lines first determined. Groups *a* to *o* recorded by photography. † Double. ‡ Strong triplets.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	4510·9	1	22162		4449·3	1½	22469
	4510·2	1	22166		4448·5	1½	22473
δ	4509·3	2	22170		4447·1	1½	22480
	4507·2	1½n	22180		4446·3	1½	22484
	4506·6	1	22183		*4444·2		22494
	4504·0	1½n	22196		4443·4		22499
	4502·7	1½n	22202		4442·7		22502
	4501·3	1½n	22209		4440·9		22511
4489·0	*4489·4	4	22270		4440·2		22515
	4488·6 ‡	5	22272		4439·5		22518
	4487·7	6	22277		4437·6		22528
	4486·8	3	22281		4437·0		22531
	4486·0	3½	22285	ε	4436·4		22534
	4485·2	3½	22289		4434·3		22545
	4484·3	3½	22294		4433·5		22549
	4483·5	3½	22298		4432·9		22552
	4482·6	2½	22302		4430·8		22563
	4482·3	2½	22304		4430·1		22566
	4481·6	2½	22307		4429·6		22569
	4480·8	3b^r	22311		4427·2		22581
	4479·4	4	22318		4426·7		22584
	4478·0	4b^r	22325		4426·0		22587
	4476·5	3	22332		4423·6		22599
	4475·9	2	22335		4423·0		22602
	4474·9	3n	22340		4422·4		22605
	4474·1	2½	22344	4417·0	*4415·9	4	22639
	4473·4	2½	22348		4414·7 ‡	5	22645
	4473·1	2½	22349		4413·6	6	22651
	4472·2	2	32354		4413·4	2½	22652
	4471·7	2½	22356		4412·8	3	22655
	4471·0	2½	22360		4411·9	3	22659
ε	4469·9	2½	22365		4411·1	3	22663
	4469·0	2	22370		4410·3	2½	22667
	4467·9	3	22375		4410·0	2½	22669
	4466·8	2	22381		4409·3	2½b	22673
	*4465·9	3	22385		4408·8		22675
	4464·8	1½	22391		4408·1	2½b	22679
	4463·8	2	22396		4407·5		22682
	4463·5	1½	22397		4407·0	2	22685
	4462·5	1½	22402		4406·3	3	22689
	4461·6	1½	22407	η	4405·9	2	22690
	4460·9	1½	22410		4404·7	4	22696
	4460·1	1½	22414		4403·3	4	22703
	4458·4	1½	22423		4401·9	3½	22711
	4457·5	1	22428		4401·4	2	22713
	4454·9	1	22441		4400·4	3	22718
	4454·1	1½	22445		4399·5	2	22723
	4452·9	1½	22451		4398·8	2	22727
	4452·2	1½	22454		4398·5	2	22728
	4451·0	1½	22460		4397·7	2	22732
	4450·0	1½	22465		4397·1	2	22736

* Chief lines first determined. Groups a to o recorded by photography. ‡ Strong triplets.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén	Hasselberg			Ångström and Thalén	Hasselberg		
a	*b*		*b*	*a*	*b*		*b*
	4396·5	2	22739		4346·4	2½	23001
	4396·0	2	22741		4345·8	2	23004
	4395·2	2	22745		4345·1	2	23008
	4394·5	2	22749		4344·4	4	23011
	4393·4	2½	22755		4343·8		23014
	4392·5	2	22759	4346·0	*4343·2	6b	23017
	4391·2	2½	22766		4342·6		23021
	4390·2		22771		4342·2	2 b	23023
	*4389·3	2	22776		4341·6	4	23026
	4388·1	1·2	22782		4341·0	1½	23029
	4387·0		22788		4340·3	4	23033
	4385·7		22795		4339·6	4	23037
	4384·7		22800		4338·8	4	23041
	4384·1		22803		4337·9	2½	23046
	4383·2		22808		4337·3	3	23049
	4382·3		22812		4336·7	2	23052
	4381·4		22817		4336·1	4	23055
	4380·7		22821		4335·4	1	23059
η	4379·8		22825		4334·8	4	23062
	4378·8		22830		4333·7	4	23068
	4378·0		22835		4333·0	1½	23072
	4377·1		22839		4332·4	2	23075
	4376·1		22845		4331·5	3	23080
	4375·2		22849		4331·0	2b	23082
	4374·4		22853		4330·4		23086
	4373·1		22860	ζ	4329·7	3½	23089
	4372·4		22864		4329·0	1	23093
	4371·7		22868		4328·0	3	23098
	4370·2		22875		4327·3	2	23102
	4369·5		22879		4326·1	3	23109
	4368·7		22883		4325·3	2	23113
	4367·9		22888		4324·3	2½	23118
	4367·1		22892		4323·4	1½	23123
	4366·4		22895		4322·4	2	23128
	4365·6		22900		4322·1	1	23130
	4364·0		22908		4321·4	1½	23134
	4363·4		22911		4320·6	2	23138
	4362·6		22915		4319·9	1½	23142
	*4356·9	4	22945		4319·2	2	23145
	4355·8	5	22951		4318·4	2	23150
	4355·0	2	22955		4317·6	1½	23154
	4354·5	6	22958		4316·9	1½	23158
	4353·4	3	22963		4316·2	1½	23162
	4352·8	4	22967		4315·3	1	23166
	4351·8	4	22972		*4314·6	1½	23170
	4350·9	4	22976		4313·9	1½	23174
ζ	4349·9	3½	22981		4312·9		23179
	4349·2	2	22986		4312·2		23183
	4348·9	3	22988		4311·5		23187
	4347·9	4	22993		4310·3		23193
	4346·8	2	22999		4309·7		23196

* Chief lines first determined. Groups a to o recorded by photography.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	4309·1		23200		4250·2	3½	23521
	4307·8		23207		4249·3	2½	23525
	4307·1		23211		†4248·3	2	23532
	4306·5		23214		4247·4	2	23537
	4305·1		23221		4246·6	2½	23541
	4304·4		23225		4246·1	2	23544
	4303·8		23228		4245·4	2½	23548
	4302·1		23238		4244·5	2½	23553
	4301·6		23240		4243·9	2	23556
ζ	4301·0	Weak Triplets	23243		4243·4	1b	23559
	4299·2		23253		4243·0		23561
	4298·6		23256		4242·4	2	23564
	4298·2		23259		4241·6	2	23569
	4296·3		23269		4241·0	2	23572
	4295·7		23272		4240·2	2	23577
	4295·2		23275		4239·4	2	23581
	4293·2		23285		4238·7	2	23585
	4292·6		23289		*4237·9	2	23589
	4292·1		23292		4236·9		23595
4271·0	*4269·4	4	23415		4236·3		23598
	4268·8 ‡	5	23419		4235·5		23603
	4268·0	6	23423		4234·4		23609
	4267·4	2	23426		4233·8		23612
	4266·8	4	23430		4233·1		23616
	4266·2	4	23433		4231·7		23624
	4265·5	3½	23437	ι	4231·1		23627
	4264·6	3	23442		4230·5		23631
	4264·1	3	23445		4229·1		23638
	4263·7	2	23447		4228·5		23642
	4263·1	3	23450		4227·9		23645
	4262·7	2	23452		4226·3	Weak Triplets	23654
	4262·4	2	23454		4225·8		23657
	4262·0	1½	23456		4225·1		23661
	4261·5	4	23459		4223·4		23670
	4260·9	2	23462		4222·9		23673
ι	4260·3	4	23465		4222·4		23676
	4259·7	1	23469		4220·5		23686
	4259·1	3½	23472		4219·9		23689
	4258·8	2	23474		4219·4		23693
	4257·9	3½	23479		4217·5		23703
	4257·2	2	23482		4216·9		23707
	4256·6	3	23486		4216·3		23710
	4256·2	2	23488		4214·2		23722
	4255·5	2½	23492		4213·7		23725
	4255·1	2½	23494		4213·2		23727
	4254·6	2½	23497		4211·0		23740
	4253·9	2½	23501		4210·5	Very Weak	23743
	4253·7	2½	23502		4210·0		23745
	4253·0	2½	23506		4208·3		23755
	*4251·9	3½	23510		4206·8		23764
	4251·2	2	23516		4204·4		23777

* Chief lines first determined. Groups a to o recorded by photography. † Double. ‡ Strong triplets.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén	Hasselberg			Ångström and Thalén	Hasselberg		
a	*b*		*b*	*a*	*b*		*b*
	4203·3		23783		4165·1	$1\frac{1}{2}$	24002
4203·0	*4201·0	4	23797		4164·5	$1\frac{1}{2}$	24006
	4200·3 ‡	5	23800		4162·6	$1\frac{1}{2}$	24017
	4199·6 ‡	6	23804		4161·9	$1\frac{1}{2}$	24021
	4199·0	3	23807		4161·2	$1\frac{1}{2}$	24025
	4198·5	4	23811		4159·9	$1\frac{1}{2}$	24032
	4197·8	4	23815		4159·3	$1\frac{1}{2}$	24036
	4197·2	$3\frac{1}{2}$b^r	23818		4158·7	$1\frac{1}{2}$	24039
	4196·4	$3\frac{1}{2}$	23822		4157·2	$1\frac{1}{2}$	24048
	4195·7	3n	23827		4156·6	$1\frac{1}{2}$	24051
	4195·5	3n	23828		4156·1	$1\frac{1}{2}$	24054
	4194·9	3	23831	κ	4154·3	1	24064
	4194·5	3	23833		4153·8	1	24067
	4194·0	$2\frac{1}{2}$	23836		4153·2	1	24070
	4193·4	3	23839		4151·5	1	24081
	4193·0	4	23842		4151·0	1	24084
	4192·2	4	23846		4150·4	1	24087
	4191·7	$1\frac{1}{2}$	23849		4148·5		24098
	4190·9	4	23854		4147·9	Very Weak	24102
	4189·7	$3\frac{1}{2}$	23861		4147·4		24105
	4189·3	$2\frac{1}{2}$	23863		4145·5		24116
	4188·4	3n	23868		4145·0		24118
	4187·7	$2\frac{1}{2}$	23872		4144·4		24122
	4187·0	3	23876	4144·0	*4141·1	4	24141
	4186·8	3	23877		4140·2 ‡	5	24146
	4186·2	$2\frac{1}{2}$	23880		4139·5 ‡	6	24150
κ	4185·7	3	23883		4138·7	3	24155
	4185·1	3	23887		4138·3	$3\frac{1}{2}$	24157
	4184·3	$2\frac{1}{2}$	23891		4137·8	2	24160
	4184·1	$2\frac{1}{2}$	23893		4137·4	$3\frac{1}{2}$	24162
	4183·4	3	23897		4136·7	$3\frac{1}{2}$	24167
	*4182·7	$3\frac{1}{2}$	23901		4136·1	$2\frac{1}{2}$	24170
	4181·9	$2\frac{1}{2}$	23905		4135·6	$2\frac{1}{2}$	24173
	4180·9	$3\frac{1}{2}$	23911		4135·1	3b	24176
	4180·0	2	23916		4134·7	3b	24179
	†4179·1	$2\frac{1}{2}$	23922		4134·0	3b	24183
	4178·1	2	23927		4133·7	3b	24184
	4177·2	2	23733		4133·1	2	24188
	4176·7	2	23935	λ	4132·6	3	24191
	4176·0	$2\frac{1}{2}$	23940		4132·2	$2\frac{1}{2}$	24193
	4175·2	1	23943		*4131·3	4	24198
	4174·6	$1\frac{1}{2}$	23947		4130·7	1	24202
	4173·6	1	23953		4130·1	4	24205
	4171·8	1	23964		4128·8	$3\frac{1}{2}$	24213
	*4170·8	$2\frac{1}{2}$	23969		4128·4	$2\frac{1}{2}$	24215
	4170·0	2	23974		4127·5	$3\frac{1}{2}$	24221
	4169·3	2	23978		4126·9	$2\frac{1}{2}$	24224
	4168·6	2	23982		4126·3	$2\frac{1}{2}$	24228
	4167·6	2	23988		4125·9	$2\frac{1}{2}$	24230
	4166·9	2	23992		4125·3	$2\frac{1}{2}$	24234
	4166·2	2	23996		4124·8	$2\frac{1}{2}$	24237

* Chief lines first determined. Groups *a* to *o* recorded by photography. † Double. ‡ Strong triplets.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén	Hasselberg			Ångström and Thalén	Hasselberg		
a	*b*		*b*	*a*	*b*		*b*
	4124·3	2½	24239		4085·2	2½	24471
	4123·6	2	24243		4084·9	2½	24473
	4123·2	2½	24246		4084·3	2	24477
	4122·7	2	24249		4083·6	3	24481
	4121·7	2½	24255		4083·3	2	24483
	4120·9	1½	24259		4082·3	4	24489
	*4120·1	3	24264		4081·0	4	24497
	4118·3	2	24275		4079·7	3½	24504
	4117·3	1½	24280		4079·4	1	24506
	4116·4	1	24286		*4078·3	3½	24513
	4115·2	< 1	24293		4077·7	1½	24516
	4114·5	< 1	24297		4077·0	2	24521
	4114·0	< 1	24300		4076·8	2	24522
	4113·3	1½	24304		4076·1	2	24526
	4112·5	1½	24309		4076·5	2	24524
	4111·9	1½	24313		4075·1	2	24532
	4111·1	1	24327		4074·4	2	24536
	4110·3	1½	24322		4074·0	2	24539
	4109·6	1½	24326	μ	4073·4	2	24542
λ	4108·9	1½	24330		4072·6	2	24547
	4108·2	1	24335		4072·4	2	24548
	4107·3		24340		4071·7	2	24553
	4106·6		24344		4070·8	2½	24558
	4105 9		24348		4069·9	1½	24563
	4104·9		24354		4068·9	2½	24569
	4104·2		24358		4068·0	1n	24575
	4103·6		24362		4067·0	1½	24581
	4102·4		24369		4066·0		24587
	4101·8		24371		4065·2		24592
	4101·1		24377		4064·9		24594
	4099·9		24384		4064·1		24598
	4099·3		24387		4063·7		24601
	4098·6		24391		4062·7		24607
	4097·2		24400		4062·0		24611
	4096·7		24403		4061·1		24617
	4096·0		24407		4060·6		24620
4098·0	*4094·2	4	24418		4059·8		24624
	4093·7	2	24421	4063·0	*4058·7	4½	24631
	4093·2	5	24424		4058·3 ‡	5	24634
	4092·1	6	24430		4057·9 ‡	6	24636
	4091·6	2½	24433		4057·3	4	24640
	4091·0	2½	24437		4056·8	4	24643
	4090·5	2½	24440		4056·3	4	24646
	4090·2	2	24442		4055·8	3½	24649
μ	4089·6	3n	24445	ν	4055·5	3	24651
	4088·9	3	24449		4055·2	3	24652
	4088·3	2½ br	24453		4054·7	3½	24655
	4087·3	2½	24459		4054·3	3	24658
	4086·9	2½	24461		4053·9	3½	24660
	4086·1	3	24466		4053·5	3	24663
	4086·0	3	24467		4053·1	3	24665

* Chief lines first determined. Groups a to o recorded by photography. ‡ Strong triplets.

NITROGEN—*continued.*

ve Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
tröm alén	Hasselberg			Ångström and Thalén	Hasselberg		
	b		*b*	*a*	*b*		*b*
	4052·7	$3\frac{1}{2}$	24668		4022·3	$1\frac{1}{2}$	24854
	4052·2	$1\frac{1}{2}$n	24671		4020·8	$1\frac{1}{2}$	24863
	4052·0	$1\frac{1}{2}$n	24672		4020·4	$1\frac{1}{2}$	24866
	4051·5	$4\frac{1}{2}$n	24675		4019·9	$1\frac{1}{2}$	24869
	4051·1	1	24677		4018·4	1	24878
	4050·9	1b^r	24678		4017·9	1	24881
	4050·5	4b^r	24681		4017·5	1	24884
	4049·4	$3\frac{1}{2}$	24688		4015·8	1	24894
	4048·9	3	24691		4015·4	1	24897
	4048·3	3	24694		4015·0	1	24899
	4048·1	3	24696		4013·2		24910
	4047·7	3	24698		4012·7		24913
	4047·2	3	24701	*n*	4012·4		24915
	4046·8	3	24704		4010·5		24927
	4046·2	$2\frac{1}{2}$	24707		4010·1		24930
	4045·8	3	24710		4009·7		24932
	4045·4	3	24712		4007·7		24944
	4045·0	1	24715		4007·3		24947
	4044·6	$3\frac{1}{2}$	24717		4006·9		24949
	4043·9	$2\frac{1}{2}$	24721		4004·9		24962
	*4043·2	4s	24724		4004·5		24964
	4042·6	$2\frac{1}{2}$	24729		4004·1		24967
	4041·7	3n	24734		4001·9		24981
	4040·9	3	24740		4001·5		24983
	4040·2	$2\frac{1}{2}$	24744		4001·1		24986
	4039·8	$2\frac{1}{2}$	24746	4002·0	*3997·8	4	25006
	4039·2	$2\frac{1}{2}$	24750		3997·2 ‡	5	25010
	4038·5	$2\frac{1}{2}$	24754		3996·6	6	25014
	4038·0	$2\frac{1}{2}$	24757		3996·4	4	25015
	4037·4	$2\frac{1}{2}$	24761		3995·9	3	25018
	4036·7	$2\frac{1}{2}$	24765		3995·4	4	25021
	4036·1	$2\frac{1}{2}$	24769		3994·9	3	25024
	4035·5	$2\frac{1}{2}$	24773		3994·7	2	25026
	4034·9	$2\frac{1}{2}$	24771		3994·3	3	25028
	4034·2	$2\frac{1}{2}$	24781		3993·9	$2\frac{1}{2}$	25031
	4033·6	$2\frac{1}{2}$	24784		3993·7	$2\frac{1}{2}$	25032
	4033·0	$2\frac{1}{2}$	24788		3993·5	$2\frac{1}{2}$	25034
	4032·2	$2\frac{1}{2}$	24793		3993·0	$2\frac{1}{2}$	25036
	4031·6	$2\frac{1}{2}$	24797	*o*	3992·7	2	25038
	4031·1	$2\frac{1}{2}$	24800		3992·3	3	25041
	4030·0	2	24807		3991·9	3	25043
	4029·5	2	24810		3991·5	$2\frac{1}{2}$	25046
	4029·0	2	24813		3991·3	$2\frac{1}{2}$	25047
	*4027·8	2	24820		3990·8	$3\frac{1}{2}$	25050
	4027·3	2	24823		3990·4	1	25053
	4026·8	2	24826		3989·8	4	25056
	4025·6	2	24834		3989·4	1	25057
	4025·1	2	24837		3989·1	1	25061
	4024·6	2	24840		3988·7	4	25063
	4023·2	$1\frac{1}{2}$	24848		3988·5	2	25064
	4022·8	$1\frac{1}{2}$	24851		3987·7	$3\frac{1}{2}$	25070

Extremely Feeble Triplets

Chief lines first determined. Groups *a* to *o* recorded by photography. ‡ Strong triplets.

NITROGEN—*continued.*

Positive Band Spectrum		Intensity and Character	Oscillation Frequency	Positive Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	3987·1	2½	25073		3971·1	2	25174
	3986·6	3	25076		3970·2	2	25176
	3986·3	3	25078		3969·6	2	24184
	3985·8	3	25082		3969·0	2	25187
	3985·4	3	25084		3968·1	1½	25193
	3985·0	3	25087		3967·6	1½	25197
	3984·3	2½	25091		3967·0	1½	25200
	3984·1	2½	25092		3965·9	1½	25207
	3983·6	2½	25095		3965·4	1½	25210
	3982·8	3½	25100		3964·9	1½	25214
	3982·1	2½	25105		3963·8	1½	25221
	*3981·2	3½	25107		3963·2	1½	25225
	3980·5	2½	25115		3962·7	1½	25228
o	3979·7	3	25120	o	3961·4	1	25236
	3979·5	3	25121		3960·9	1	25239
	3978·9	2½	25125		3960·4	1	25242
	3978·1	2½	25130		3959·1	1	25251
	3977·8	2½	25132		3958·6	1	25251
	3977·2	2½	25136		3958·1	1	25257
	3976·5	2½	25140		3956·6		25267
	3976·0	2	25143		3956·1		25270
	3975·5	1	25146		3955·7		25272
	3975·3	1½	25148		3954·1	Very Feeble Triplets	25283
	3974·8	2½	25151		3953·6		25286
	3974·1	2	25155		3953·2		25288
	3973·5	2	25159		3951·5		25299
	3972·9	2	25163		3951·1		25302
	3972·2	2	25167		3950·7		25304
	3971·6	2	25171				

NITROGEN.

Hasselberg, 'Mém. de l'Acad. St. Pétersb.' xxxii. No. 15.

Negative Band Spectrum		Intensity and Character	Oscillation Frequency	Negative Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
4709·3	*4708·6	5	21231		4694·4	1	21297
	4706·8	1	21240		4692·8	3	21303
	4704·6	1	21249		4691·1	1	21311
	4702·8	1	21258		4689·4	3	21318
A	4701·0	2	21266	A	4687·5	1	21327
	4699·9	1	21271		4685·6	2½	21337
	4698·7	2½	21277		4683·6	1	21345
	4697·2	1	21287		4681·5	2	21354
	4695·9	3	21290		4679·3	1	21364

* Chief lines first determined. Groups *a* to *o* recorded by photography.

NITROGEN—*continued.*

Negative Band Spectrum		Intensity and Character	Oscillation Frequency	Negative Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	4677·2	1½	21374		4548·0	1	21981
A	4674·7	1	21385		4547·0	2	21986
	4672·3	1	21396		4546·0	1	21991
	4667·3	1	21419		4545·0	2b^r	21996
4653·5	*4651·2	5	21493		4543·8	1	22001
	4649·2	2	21503		4542·9	2	22006
	4644·8	1	21523		4542·0	2	22010
	4643·8	2	21528		4540·9	2	22015
	4642·6	1½	21533		4539·5	1½	22022
	4641·5	2½	21538	D	4538·0	1	22030
	4640·2	1½	21544		4536·4	2	22038
	4638·8	2½	21551		4535·3	1	22043
	4637·4	1½	21557		4534·0	1	22049
	4635·9	2½	21564		4533·3	1	22053
	4634·3	1½	21572		4532·5	1½	22057
B	4633·3	1	21576		4529·8	1½	22070
	4632·7	2½	21579		4529·1	1½	22073
	4631·1	1	21587		4525·7	1	22090
	4629·9	3	21592		4525·4	1	22091
	4629·0	1	21596		4521·4	1	22111
	4627·2	1½	21605	4516·5	*4515·3	5	22140
	4625·1	1	21615		4514·3	1½	22145
	4624·6	1	21617		4513·4	1½	22150
	4620·8	2½	21635		4512·7	1½	22153
	4616·1	1½	21657		4512·2	1½	22156
	4609·0	1½	21690		4510·1	1½	22166
	4606·5	1½	21702		4509·2	1	22170
	4600·9	1½	21728		4508·3	2	22175
					4507·3	1	22180
4601·2	*4599·4	5	21735		4506·2	2½	22185
	4597·7	2	21743	E	4505·1	1	22191
	4596·5	2	21749		4503·9	3	22196
	4594·3	1½	21759		4502·6	1	22203
	4593·2	1	21765		4501·3	3	22209
	4592·2	2	21769		4499·9	1	22214
	4591·2	1	21774		4498·5	2½	22223
	4590·1	2½	21779		4496·9	1	22231
	4588·8	1½	21786		4495·3	2	22239
C	4587·4	3	21792		4493·6	1	22248
	4586·1	1½	21798		4491·9	2	22255
	4584·7	3	21805	F	4484·9	4	22291
	4583·1	1½	21813		4484·3	4	22293
	4581·5	3	21820	4281·0	*4278·0	5	23368
	4579·8	1½	21828		4276·9	3	23374
	4578·1	2½	21836		4276·5	3	23376
	4576·1	1	21846		4276·1	3	23379
	4574·3	1	21855	G	4275·6	2½	23381
	4570·2	2	21874		4275·0	3	23385
4555·2	4553·8	5	21953		4274·4	2	23388
	*4552·9	5	21957		4272·9	2½	23396
	4549·0	1½	21976		4272·1	2	23401

* Chief lines first determined. Groups A to K recorded by photography.

NITROGEN—*continued.*

Negative Band Spectrum		Intensity and Character	Oscillation Frequency	Negative Band Spectrum		Intensity and Character	Oscillation Frequency
Ångström and Thalén *a*	Hasselberg *b*		*b*	Ångström and Thalén *a*	Hasselberg *b*		*b*
	4271·2	$3\frac{1}{2}$	23405		4219·1	1	23695
	4270·2	$2\frac{1}{2}$	23411		4218·4	$1\frac{1}{2}$	23698
	4269·2	4	23416		4217·6	2	23703
	4268·0	$2\frac{1}{2}$	23423		4216·1	2	23712
	4266·9	4	23429		4215·4	1	23715
	4265·7	$2\frac{1}{2}$	23436		4214·5	2	23720
	4264·5	4	23442		4214·1	2	23723
	4263·1	3	23450		4212·7	2	23730
	4261·7	4	23458		4211·1	2	23740
	4260·3	$2\frac{1}{2}$	23465		4209·3	1	23749
G	4258·8	4	23474		4207·6	$1\frac{1}{2}$	23759
	4257·2	$2\frac{1}{2}$	23482		4203·6	1	23782
	4255·5	$3\frac{1}{2}$	23492	4203·0	*4198·7	5	23810
	4253·9	2	23501		4198·3	4	23812
	4252·2	3	23510		4197·7	$3\frac{1}{2}$	23815
	4250·3	2	23520		4196·9	$3\frac{1}{2}$	23820
	4248·5	$2\frac{1}{2}$	23531		4196·4	2	23823
	4246·5	$1\frac{1}{2}$	23542		4195·9	2	23825
	4244·6	2	23552		4195·3	2	23829
	4242·6	1	23563		4193·9	$1\frac{1}{2}$	23837
	4240·4	1	23575		4193·3	2	23840
	4236·5	1	23597		4192·3	2	23846
4239·0	*4236·3	5	23598		4191·4	$1\frac{1}{2}$	23851
	4235·1	$3\frac{1}{2}$	23605		4190·6	$2\frac{1}{2}$	23856
	4234·3	3	23609	I	4189·6	1	23861
	4233·9	2	23612		4188·4	3	23868
	4233·3	$2\frac{1}{2}$	23614		4187·3	1	25874
	4232·8	$1\frac{1}{2}$	23618		4186·1	3	23881
	4231·3	2	23626		4185·0	$1\frac{1}{2}$	23887
	4230·4	$1\frac{1}{2}$	23631		4183 6	3	23895
H	4229·5	3	23636		4182·3	$1\frac{1}{2}$	23903
	4228·6	2	23641		4180·9	$2\frac{1}{2}$	23911
	4227·6	$3\frac{1}{2}$	23647		4179·4	1	23920
	4226·6	$2\frac{1}{2}$	23652		4177·9	2	23929
	4225·5	4	23659		4176·4	$1\frac{1}{2}$	23937
	4224·4	$2\frac{1}{2}$	23665		4174·7	1	23947
	4223·1	4	23672		4172·9	< 1	23957
	4221·9	$2\frac{1}{2}$	23678		4171·3	1	23966
	4220·5	$3\frac{1}{2}$	23687	K 4175·0	*4166·3	3	23995
	4219·4	1	23693		*4165·6	3	23999

* Chief lines first determined. Groups A to K recorded by photography

Oxygen.

Deslandres, 'Ann. Chim. Phys.' (6) xiv. 257 (1888).

I. Compound Line Spectrum	II. Elementary Line Spectrum	Intensity and Character	Oscillation Frequency
3955·3		4	25275
3948·2		7	25320
3823·8		2	26144
	3749·6	6	26662
	3727·4	5	26820
	3711·9	2	26932
3692·0		1	27078
	3408·4	4	29331
	3390·5	3	29485
	3377·8	1	29596
	3139·4	6	31843
	3135·3	6	31885
2883·5		3	34669
	2447·5	4	40845
	2433·6	2	41078

Platinum.

Hutchins and Holden, 'Proc. Am. Acad.' xxiii., 'Phil. Mag.' xxiv. 325 (1887), give following lines of Platinum on the scale of Rowland's map: 4932·4, 4899·0, 4857·7, 4852 4580·8, 4560·3, 4552·8,* 4481·8, 4455·0,* 4448·0, 4445·7, 4440·7, 4435·2, 4430·4, 4392 4291·1.

* Agree with lines observed by Thalén.

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